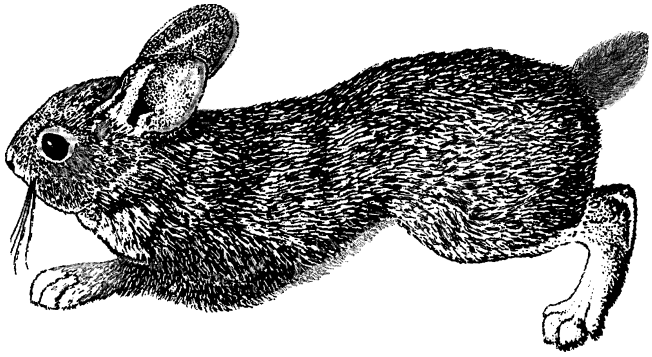
HABITAT MANAGEMENT FOR RIPARIAN BRUSH RABBITS AND WOODRATS WITH SPECIAL ATTENTION TO FIRE AND FLOOD

FINAL REPORT IN PARTIAL FULFILLMENT OF THE CENTRAL VALLEY PROJECT IMPROVEMENT ACT,
Section 3406(b)(1)



Submitted to:
U.S. BUREAU OF RECLAMATION
SOUTH-CENTRAL CALIFORNIA AREA OFFICE
2666 N. GROVE INDUSTRIAL DRIVE, SUITE 106
FRESNO, CA 93727-1551

by
CONNIE LEE CLOSE AND DANIEL F. WILLIAMS
ENDANGERED SPECIES RECOVERY PROGRAM
DEPARTMENT OF BIOLOGICAL SCIENCES
CALIFORNIA STATE UNIVERSITY, STANISLAUS
TURLOCK, CA 95382
(209) 667-3477

21 SEPTEMEBER 1998

Fire (upper) and flood (lower) pose severe threats of extinction to the only major remanent riparian community in the San Joaquin Valley and the species it supports, including the endemic riparian brush rabbit and riparian woodrat. Upper photo of fire at the Audubon Society's Bobelaine Sanctuary on the Feather River taken by Bill Clark; lower photo of Caswell Memorial State Park by Connie Lee Close.

HABITAT MANAGEMENT FOR RIPARIAN BRUSH RABBITS AND WOODRATS WITH SPECIAL ATTENTION TO FIRE AND FLOOD

by

Connie Lee Close and Daniel F. Williams
Endangered Species Recovery Program
Department of Biological Sciences
California State University, Stanislaus
Turlock, CA 95382

EXECUTIVE SUMMARY

This report identifies and discusses issues and presents recommendations on prefire and flood planning for Caswell Memorial State Park (CMSP) on the Stanislaus River, San Joaquin County, California. Fire and flood (frontispiece) pose severe threats of destroying the only major remnant riparian community in the San Joaquin Valley and the last refuge for the riparian brush rabbit (*Sylvilagus bachmani riparius*) and riparian woodrat (*Neotoma fuscipes riparia*). The riparian brush rabbit is a California endangered species, and both species have been proposed for listing as endangered by the federal government. In addition, the Park is used seasonally or is home to six other threatened and endangered species and several rare and candidate plants, and the communities represented, Great Valley Mixed Riparian Forest, Great Valley Oak Riparian Forest, and Elderberry Savanna, are themselves considered to be threatened or endangered.

The Park is highly vulnerable to flooding because of channelization brought on by levee construction. Lack of vegetation management and long-term fire suppression have resulted in accumulation of great amounts of fuel and decadence of the woody vegetation, leading to a severe threat of catastrophic wildfire. Stakeholders that need to be involved in solutions aimed at reducing the threats of fire and flooding include the California Department of Parks and Recreation (CDPR), Ripon Consolidated Fire District (RCFD), California Department of Forestry, U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, Lower San Joaquin Levee District, Stanislaus River reclamation districts, U.S. Fish and Wildlife Service, California Department of Fish and Game, San Joaquin Valley Air Pollution Control District, California Indian Basketweavers Association, and the landowners adjacent to Caswell MSP.

Trails and roads in the Park are mowed periodically and maintained for access and fuel breaks. Yet the trails and road in the undeveloped portion of the park are too narrow to be effective fuel breaks. The existing well and water distribution system are not designed for or capable of delivering the volume of water needed to fight fires. Further, the Park does not have adequate fire fighting equipment on site and Park personnel are not trained in fire-fighting. Recommendations for lessening fire hazards and fighting fires include:

- clear downed fuel and decadent vegetation from a few strategic strips that could serve as staging and access areas for containing a major wildfire;
- construct an emergency ingress-egress road from the campground at the east end of the Park and identify other emergency ingress-egress routes;
- reduce fuel loading through prescribed burning, mechanical removal, and hand removal;
- reduce ladder fuels by pruning and pulling vines from trees;
- conduct periodic inspections by and consultations with the Ripon Consolidated Fire District;
- maintain fire roads and fuel breaks;
- identify areas of the Park where aggressive fire fighting efforts should take place, and ensure proper access to them, and identify areas where these actions are not appropriate;
- provide a reliable source of water for fire fighting purposes, including fire hydrants supplied by rated fire pumps capable of 500-1,000 gal/min, with a standby generator or some other source of power;
- standardize existing standpipe outlets to a size that will accommodate single-jacket wildland fire hose;
- supply at least 100 ft (30.5 m) of hose in boxes near the standpipes to enable park personnel to hook up to the available water supply that exists throughout the developed section of the Park;
- train Park employees in basic firefighting tactics and supply them with standard firefighting tools;
- acquire "quick attack" or booster hard line(s) and mount on one or more of the Park vehicles.
- consider the role Native American basketweavers can play in maintaining biotic community dynamics through their activities of gathering plant materials in the Park, and review policies that may help promote activities that would benefit wildlife habitat;

Providing an on-site water supply to fight fires within the Park is not possible with the existing budget allocations, and may require support from one or more agencies involved in protecting and restoring riparian communities and threatened and endangered species. In

addition to the need for a new or upgraded water-distribution system consisting of about 5,000 ft of 10-inch pipe, a new well that is capable of an output of 1,000-1,200 gpm and a 30 horsepower submersible pump are needed. Costs of these and other items identified as needed to develop a quick-response firefighting capability at Caswell MSP are estimated as follows: well, 1,000 gpm pump, 5,000 ft of 10-inch water line, and hydrants, $188,164; firefighting equipment for Park staff, $1,000; clearing and improving access and staging areas for firefighting, $10,000; standardize existing standpipes to accommodate wildland hose and supply 100-ft of hose at each standpipe, $7,545. Other costs associated with environmental assessment, monitoring, and planning are estimated at $15,000. No estimate could be made for the cost of constructing an emergency ingress-egress road from the campground because the road would have to be located on private land, and CDPR must first negotiate with the land owner for an easement.

There are few options in Caswell for reducing the impact of floods on terrestrial animals, including brush rabbits and woodrats. Constructing elevated mounds that would remain above flood level during severe flooding has been explored and the issues identified. These include potential archaeological resources, impacts on the existing natural community by construction activities, potential alteration of water flow, the costs of acquiring and transporting dirt for construction of mounds, and alternate ways of obtaining fill dirt. Though we cannot estimate costs now, we believe the costs and impacts of mound construction may make this alternative impractical, though it should be more thoroughly explored by affected entities. Another alternative would be to direct funds for these activities to restoring and protecting habitat for brush rabbits and woodrats on the San Joaquin River National Wildlife refuge or other public land within the historical range of these species. Costs for locating and mapping areas for refuge mounds and determining the feasibility of constructing mounds are estimated to total about $10,000.

We recommend providing cover and food on levees for animals seeking refuge from floods. This will require the cooperation of the Stanislaus River resource districts and landowners who own the levees. Providing cover can be done in ways that will not jeopardize levee integrity or the ability to inspect levees for erosion and other potential defects. Planting perennial grasses on the levees would provide a source of food for refuging rabbits and reduce or negate the need to use herbicides to control weeds.

ACKNOWLEDGMENTS

Funding for this project was provided by a grant from the Central Valley Project Improvement Act, "B. (1.) Other" program, and from other sources of the U.S. Bureau of Reclamation's South Central California Area Office. Additional funding was provided by the California Department of Fish and Game's Bird and Mammal Conservation Program. We thank Rosalie Faubion and Ronald Schlorff for their generous support of this project. Developing this report would not have been possible without the cooperation and assistance of the individuals listed in the reference section under "personal communications." We especially want to acknowledge the contributions of Tim Neeley and Al Chavez of the California Department of Parks and Recreation, Gene Vander Plaats and Dennis Bitters of the Ripon Consolidated Fire Department, and Beverly Stevenot and Steve Nicola of the California Indian Basketweavers Association. Former park ranger, Ken Martin provided much background information on the history and potential archaeological resources of the Park. Bill Clark provided several pre- and post-fire photos of Audubon's Bobelaine Sanctuary. Steven Clifton, Laurissa Hamilton, and Howard Clark, Jr., of the Endangered Species Recovery Program were the principals in field work in the Park during 1997 and 1998. Patrick Kelly, Director of the Endangered Species Recovery Program, and its support staff in Fresno, including Scott Phillips and Nikki Eanni, contributed in numerous ways to the execution of the project.

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

TABLE OF CONTENTS (cont.)

TABLE OF FIGURES AND TABLES

INTRODUCTION

Background

The only known extant populations of the riparian brush rabbit *(Sylvilagus bachmani riparius)* and the riparian woodrat *(Neotoma fuscipes riparia)* are located in Caswell Memorial State Park (CMSP), on the Stanislaus River in southern San Joaquin County, California. Because of their restricted distributions, small extent of occupied habitat, and high risks of extinction from flooding, wildfire, disease, and demographic stochasticity, both the riparian brush rabbit and riparian woodrat have been proposed for listing as threatened or endangered by the Fish and Wildlife Service (USFWS 1997). The riparian brush rabbit was listed as endangered by the State of California in May 1994 (Williams et al. 1997). The riparian woodrat is treated as a "Species of Concern" by the California Department of Fish and Game (Williams 1986).

The Central Valley Project was a key factor in the destruction and degradation of riparian communities along the San Joaquin River and its tributaries and the ultimate endangerment of riparian species such as the brush rabbit and woodrat, both of which were common along the lower portion of the river into the 1950's. Control of annual flooding and by Friant Dam and water exchange via the Delta Mendota Canal led to intensive, irrigated agriculture in most of the former floodplain of the River. Channelizing the river with levees and tree and brush clearing within the river channel eliminated most or all habitat for non-vagile terrestrial species and also promoted intensive agriculture on low-lying land on the outside of the levees. Similar flood and irrigation control programs on the Merced, Stanislaus, and Tuolumne rivers resulted in the current situation where there is no place for non-volant riparian species to refuge from flooding (Williams and Basey 1986, Williams 1988).

Caswell Memorial State Park (CMSP) is located in the Central Valley of California, approximately 6 miles (9.7 km) west of the city of Ripon. A single entrance to the Park is located at the south end of Austin Road, accessed by West Ripon Road and Austin Road exits off of California Highway 99. The Stanislaus River runs along the southern and western boundaries of the Park.

Purpose of this plan.—The objectives of this plan are to enhance, restore, and protect habitat for the riparian brush rabbit and the riparian woodrat and a variety of other species, including several jeopardized Neotropical migrant birds, through prefire and flood planning for CMSP, and to facilitate interagency cooperation between the Endangered Species Recovery Program (ESRP), the California Department of Parks and Recreation (CDPR), the Ripon Consolidated Fire District (RCFD), and other mutual-aid fire and resource-management agencies. Catastrophic wildfire has the potential to destroy one of the few remaining extant ecosystems essential to these two species. A comprehensive fuels management program within the Park and cooperative efforts between CDPR and local fire response agencies will facilitate achieving ecosystem and fire management goals in a manner consistent with the missions of each agency. In addition to a comprehensive fuels management program, the development of flood refugia within the Park will enable the riparian brush rabbit and ripar-

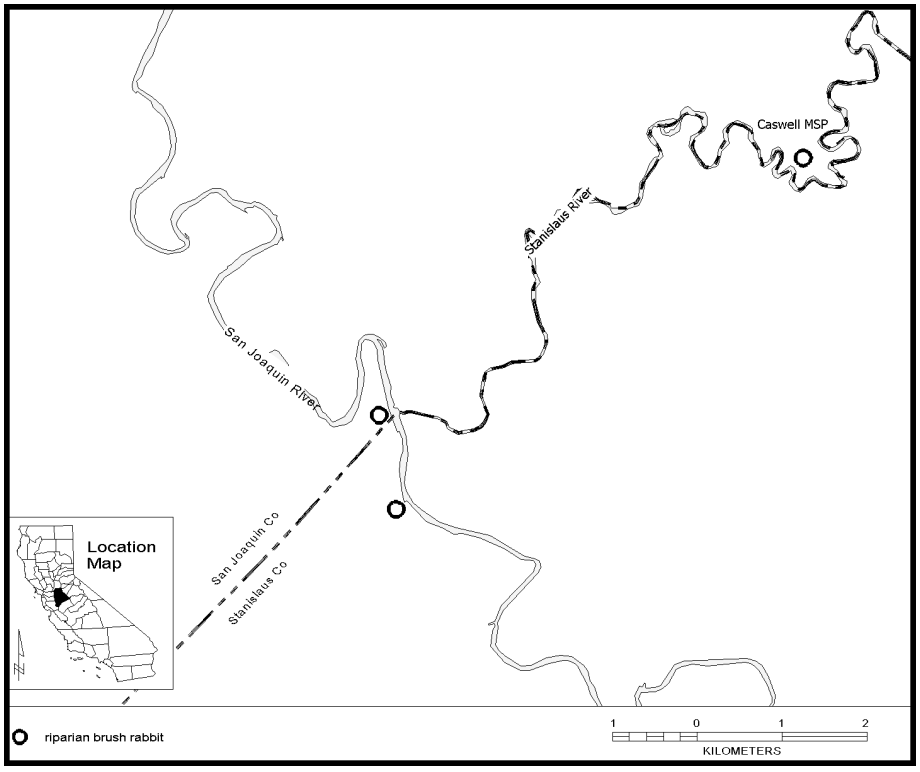


Figure 1. *Historical distribution records for the riparian brush rabbit (circles). The only known extant population is in Caswell Memorial State Park.*

ian woodrat to refuge in the event of severe flooding, such as seen during January of 1997 and which has occurred four times since completion of New Melones Dam in the 1970's (D. Williams, unpubl. data).

To achieve these goals, two separate but related activities are taking place. First, ESRP, CDPR and the RCFD are working together to discover and develop a fuels management program that will satisfy and stay within the parameters and mission statements of each agency. Second, prefire and preflood planning activities examine all current or expected conditions, including:

a. human use: day, time, season, area;

b. the physical environment: ingress and egress to the area, access to a reliable water source, topography, fuel structure and load, weather conditions, flood patterns (frequency, level, duration), and the presence of historic or prehistoric archaeological sites;

c. biological environment, including amounts and types of vegetation, species richness, and the presence of threatened or endangered species. Prefire planning also must include consideration of available equipment, staff training, and cooperative agree-

ments or memoranda of understanding (MOU's), all of which must work together to address the prevention and extinguishing of fires anywhere within the Park. Preflood planning additionally must consider effects of any flood control structures and flood refugia on water flow and levee integrity.

These management measures are directed at protecting the ecosystem at Caswell MSP. Preplanning is often easier to implement, has greater rates of success, and is far less expensive than restoration of an area that has been decimated by wildfire or flooding (Kauffman et al. 1997). Sheppard and Farnsworth (1995) pointed out that "with careful preplanning, land managers can reduce the damage resulting from wildfires and wildfire suppression in threatened and endangered species habitat."

A case in point is the Audubon Bobelaine Sanctuary on the Feather River. This property is very similar to Caswell—a climax riparian forest with thick, untouched understory, abundant ladder fuels, and little historical vegetation management. In 1992, a suspected arson-caused fire started about 6 miles north of the sanctuary and was blown by very high winds, causing severe damage (Frontispiece; Appendix A, Plates 1 & 2, p. 31). The fire burned hottest in areas where the vegetation was thickest. While this is an obvious action of fire in thick vegetation, Bobelaine managers now see that clearing some of the decadent fuels, creating more firebreaks, and widening the trails might have slowed the fire progress (Bill Clark pers. comm.). Additional consequences of the fire on Bobelaine Preserve, aside from the loss of wildlife habitat, were the social and financial impacts. The Preserve was closed for about 1 year following the fire while extensive restoration projects were initiated or completed.

Stakeholders.—Following is a list of potential and actual stakeholders in the proposed community protection and restoration plan for Caswell MSP.

California Department of Parks and Recreation has responsibility for planning and implementation of management goals within Caswell MSP.

Ripon Consolidated Fire District (RCFD) has responsibility for initial fire and rescue response within and around Caswell MSP. According to Fire Chief Gene Vander Plaats (pers. comm.), the department is willing to participate in prefire planning strategies and controlled burning activities that are determined to be necessary to achieve vegetation management and fire safety objectives.

California Department of Forestry (CDF) is responsible for fire protection services, and when available, rescue, first aid, and other emergency services, either directly or through contractual agreements, and to those areas and communities for which the Department of Forestry and Fire Protection is responsible by local government fire protection contracts (CDF 1998*a*). CDF has agreements with federal, state, and local jurisdictions, including CDPR, to provide for contract fire protection, assistance by hire, and mutual aid. At CMSP, CDF would respond if and when the RCFD determined that a wildfire was beyond its ability to control.

Endangered Species Recovery Program's (ESRP) mission is to facilitate endangered species recovery by assisting CDPR in developing prefire, flood, and community management plans for Caswell MSP.

U.S. Bureau of Reclamation's (BR) mission is to manage, develop and protect water and related resources in an environmentally and economically sound manner. BR is a stakeholder in this plan because of CVPIA (Title 34 of PL 102-575), and their commitments relative to the Friant Biological Opinion (USBR 1991).

U.S. Army Corps of Engineers (COE) is responsible for managing federally-owned fish and wildlife habitats along the lower Stanislaus River. Ordinary flowage and wildlife habitat easements, the latter acquired for mitigation for New Melones Dam, are owned by COE on land parcels surrounding Caswell MSP and all along the course of the Stanislaus River below New Melones dam. COE has primary responsibility for monitoring and enforcement of compliance with easement conditions by land owners. Under most circumstances, property owners having fish and wildlife easements are prohibited from removing native vegetation and removing, shifting, or altering gravel deposits.

Lower San Joaquin Levee District is responsible for the maintenance of the levees, channels, bypasses, and other appurtenant facilities along the lower San Joaquin River.

Stanislaus River Reclamation districts are responsible for maintenance of levees along the lower Stanislaus River. These include Rd. No. 2064 (River Junction Resource District) San Joaquin Co.; Rd. No. 2085 (Kasson District) San Joaquin Co.; Rd. No. 2101 (Blewett District), Stanislaus Co.; and Rd. No. 2031 (Elliott), Stanislaus Co.

U.S. Fish and Wildlife Service (USFWS) has statutory responsibility for listing, reclassifying, and delisting species under the Endangered Species Act (ESA), and is responsible for enforcing provisions of the ESA and overseeing recovery activities.

California Department of Fish and Game (CDFG) has primary responsibility for the protection of fish and wildlife within the State of California.

Landowners adjacent to Caswell MSP and across the Stanislaus River may choose to participate in the flood, vegetation management, or prescribed fire planning processes. All landowners adjacent to and near Caswell will need notification of prescribed burning or other activities that may affect their interests.

California Indian Basketweavers Association (CIBA) considers Caswell MSP as an important gathering location by its members and other Native American groups. Plants important to the construction of baskets and other items include sedge (*Carex* sp. and *Cyperus* sp.) and willows (*Salix* spp.). CIBA members believe that gathering activities within Caswell will benefit the riparian vegetation management program (B. Stevenot

pers. comm.).

San Joaquin Valley Air Pollution Control District has responsibility for monitoring air quality within the San Joaquin Valley. The standards that are set for air quality restrict the number of allowable burn days.

Ownership of CMSP.—Fee ownership of Caswell MSP belongs to the State of California. Implementation of fire and habitat management is ultimately the responsibility of the Department of Parks and Recreation.

History of CMSP.—Prior to becoming state property, the Park property was owned by the Thomas Caswell family who farmed adjacent to the river. In 1950, family members donated 134 acres (41 ha) to the people of California. In later years, the state purchased adjacent land and local organizations made additional contributions to bring it to its current 258 acres (79 ha). Caswell MSP opened to the public in 1958.

Current status of CMSP.—The Park is visited by thousands of people each year, many of whom use the campground, which offers 65 individual camping sites, each with a table, camp stove and food locker. Drinking water and bathrooms with showers are available nearby. Visitors to the Park may fish, swim, and hike, and observe nature along several trails through stands of valley oaks, California black walnuts, and willows.

The Park has a dense understory of shrubs and vines with mostly old trees, and much of this vegetation is decadent and highly flammable. The ground is covered with deep accumulations of duff and woody litter. Fire suppression, exclusion, and lack of a comprehensive fuels management program for more than 50 years has left the Park with extreme fuel loading (Appendix A, Plates 3 & 4, p. 33). These conditions pose a serious threat of catastrophic wildfire. Ladder fuels of heavy vines contribute to the likelihood of uncontrolled fire migrating into the tree canopy. To compound the problem, the Park was severely flooded during the storms of January 1997, and received additional fuel loads from many downed trees. This contribution of flammable material makes the possibility of catastrophic wildfire an even greater threat.

History of vegetation management at CMSP.—Vegetation removal within Caswell MSP has been minimal since it was acquired by the CDPR. Areas cleared include camping, parking lots, and recreation trails. Clearing of drainage channels for mosquito control is done on an annual basis. Additional spraying of herbicides and clearing of vegetation are done annually on the levees bordering the Park. Vehicle access roads and trails are cleared and mowed on a regular basis. Yet recent cuts in California Youth Authority crews has drastically reduced the vegetation removal work that is accomplished at the Park (J. Jacquier pers. comm.).

Fire history.—There is no evidence available to indicate that prescribed fire was used by Native Americans to modify the environment at CMSP. There is no information available to indicate there was prescribed burning by the Caswell family, or since the donation and acquisition of additional property by the state of California. Between 1975 and 1987,

10 wildfires were reported—all were quickly extinguished. The largest fire burned only about 0.66 acre (0.2 ha). Eight of the 10 fires began in or near high use picnic and camping areas (Williams 1988). Fire history since 1987 shows three river-bottom fires and five grass fires, with no fire exceeding 2 acres (0.61 ha; G. Vender Plaats, pers. comm.).

CONSIDERATIONS FOR BIOTIC COMMUNITY MANAGEMENT

The Physical Environment

Location and structures in Caswell MSP.—Agricultural land runs along the northern boundary of the Park. Longitude of the Park is 121º 41' 36" W, latitude is 37º 41' 36" N on the Ripon quadrangle. The Park is about 40 ft (12 m) above sea level. Buildings within the Park consist of the small entrance station, one park residence, the Park service yard and workshop, which are located near the camping area, one mobile home located between the first and second visitor parking areas, and five restroom buildings.

Topography.—The terrain consists of relatively flat, riparian floodplain. The Park drops down to the Stanislaus River along its eastern and southern boundaries. There are several drainage channels and ditches that originate from the agricultural land to the north and empty into the river. There are several low areas within the Park that typically fill with water during the wet season.

Soils.—Soils are the Columbia Series and are a fine sandy loam. Soils were formed in alluvium derived from mixed rock sources. The surface layer is pale brown fine sandy loam about 12 inches (30.5 cm) thick. The underlying material is stratified to a depth of 60 inches (1.52 m). Thus there is very deep, somewhat poorly drained, nearly level soil on the flood plain. Runoff is slow, and the hazard of soil erosion is moderate. Permeability is moderately rapid. (San Joaquin Soil Survey 1992).

Climate.—The Mediterranean-type climate of this region is characterized by hot, dry summers and cool, moist winters. Summer climate is ruled by a persistent high-pressure area offshore that keeps most weather systems from entering the county. Mean annual precipitation is about 12.1 inches (30.5 cm). About 90% of the total annual rainfall falls between November and April. Humidity is high during the moist winter months but becomes low on hot summer afternoons. Late in fall and early in winter, cold air from the surrounding mountains and radiant cooling result in fog under stable atmospheric conditions (San Joaquin Soil Survey 1992).

Fire-weather considerations.—The predominant wind pattern from mid-March through mid-November is from the northwest or west-northwest, with wind patterns more variable in the winter. From November through February, the prevailing wind patterns are from the southeast. On fog days, the strongest winds may be in the afternoon between 3 to 5 mph (4.8 and 8.1 km/h) and may be 8 to 10 mph (12.9-16.1 km/h). During storm periods, the winds could be from any direction, and vary in direction and speed throughout the day. The av-

erage wind speed from December through March is 6.75 mph (10.86 km/h), with the average maximum wind speed in December through March at 29.25 mph (47.06 km/h; U.S. National Weather Service 1997).

Plant Communities

The flora of CMSP is unique within the California State Park system in that it is derived predominantly from the riparian woodland associations endemic to the Central Valley of California. These woodlands, described by Holland (fide Quinn and Hrusa 1993), were at one time present along nearly every stream that flows through the Central Valley. Caswell MSP, while not in a pristine condition, is representative of Holland's Great Valley Cottonwood Riparian Forest, Great Valley Mixed Riparian Forest, and Great Valley Oak Riparian Forest.

Threatened and endangered plant communities.—Three plant communities found within Caswell MSP (CDFG 1997) are considered to be threatened or endangered.

The **Great Valley Mixed Riparian Forest** has a Global (G2) rating and is considered to be habitat for elderberry longhorn beetles and nesting habitat for great blue herons. This community is characterized by *Acer negundo, Salix hindsiana, Populus fremontii,* and *Fraxinus latifolia,* among others.

The **Great Valley Oak Riparian Forest** has a Global (G1) rating and a State rank of S1.1 and is adjacent to the mixed riparian forest and characterized by *Quercus lobata, Acer negundo, and Vitis californica,* with *Carex barbarae* and *Elymus tritichoides* extensive in the herb layer.

The **Elderberry Savanna** has a Global (G2) rank, and a State S2. Elderberry *(Sambucus mexicana)* is the host plant for the Federally threatened Valley elderberry longhorn beetle *(Desmocerus californicus dimorphus)*.

Wildlife

Twenty-two species of mammals have been documented for CMSP (Elems and Medeiros 1977, Williams 1988, Cook and Quinn 1992). Among these, four are exotic species, including the feral cat *(Felis sylvestris*), black rat *(Rattus rattus*), Norway rat (*Rattus norwegicus*), and house mouse (*Mus musculus*). A list of animal species recorded for CMSP is included in Appendix B. There are approximately 95 species of birds known or thought to nest at CMSP (Elms et al. 1977, Meese 1992). Many species of birds are migratory, consequently, the number of species and the size of populations vary considerably from season to season (Appendix B).

Threatened and Endangered Species

The California Department of Fish and Game and the United State Fish and Wildlife Service list eight species that occur in Caswell MSP as threatened, endangered, or proposed for listing. Five of these species are residents at CMSP, while others occur on an intermittent basis because of migration. Still others are known to have existed at the Park in the past, but their current statuses is unknown.

The threatened and endangered species that occur within Caswell MSP influence management of its environment. The potential change in status of any of these species will further dictate how the environment can be manipulated or altered in the future. Additional wildlife inventories that include in-depth studies of taxa found within the Park are necessary. To date, little or no information is available regarding invertebrate species that are dependent upon riparian systems.

Threatened and Endangered Species known to exist within CMSP now include:

Riparian brush rabbit (*Sylvilagus bachmani riparius)* is California endangered and federally proposed for listing. The last population estimate for the rabbit in Caswell MSP was 213 to 312 individuals in January of 1993 (Williams 1993). During severe flooding in January 1997, about 90% of the Park and over 90% of the rabbit's habitat were under water (Frontispiece; Appendix A, Plate 5, p. 35). Trapping efforts for riparian brush rabbits at Caswell was initiated on April 21, 1997 by ESRP. Between then and March 1998, only one rabbit was captured. A juvenile rabbit was found dead in August 1997, and a few rabbits were sighted by ESRP and Park personnel during that period. Though no quantitative basis for a population estimate is possible because of lack of captures, based on sign and sightings we believe the current population numbers no more than 5-15 individuals.

Riparian woodrat *(Neotoma fuscipes riparia)* is a California Species of Concern and federally Proposed for listing. The most recent estimate of the size of this population (Williams 1993) was 437 individuals. Trapping efforts by ESRP during April 1, 1997 to March 20, 1998 yielded 15 woodrats captured.

Swainson's hawk *(Buteo swainsoni)* is a California threatened species. A pair of Swainson's hawks was known to have bred at Caswell in 1992, in the northeast portions of the Park (Meese 1992). Central Valley populations of Swainson's hawks frequently nest in valley oaks (*Quercus lobata)* and Fremont cottonwoods *(Populus fremontii)*. Often trees chosen as nest sites are within 100 yards (90 m) of a major Valley stream or slough in the riparian zone. Swainson's hawks appear to choose relatively tall trees for nest sites (Schlorff and Bloom 1984).

Aleutian Canada goose *(Branta canadensis leucopareia)* is California endangered and USA threatened. These geese have been observed in the Park on several occasions dur-

ing the months they winter in the Valley (e.g., Meese 1992). Aleutian Canada geese first appear in the San Joaquin Valley during the third or fourth weeks of November. The peak population date has ranged from 22 December to 6 February. The geese prefer harvested cornfields for feeding, and small ponds and lakes for roosting (Springer and Gregg 1992).

Greater sandhill crane *(Grus canadensis tabida)* is California threatened. They have been recorded at Caswell, being observed during a survey conducted in 1992 (Meese 1992)

Western yellow-billed cuckoo *(Coccyzus americanus occidentalis)* is California endangered. Sightings and vocalizations of the cuckoo were recorded by ESRP personnel in 1997 (S. Clifton and L. Hamilton pers. comm.). There is anecdotal evidence of cuckoos in the vicinity of CMSP in the early 1980's (H. Reeve pers. comm.) in addition to historical records (CDFG 1997).

Valley elderberry longhorn beetle *(Desmocerus californicus dimorphus)* is federally listed as a threatened Species. According to Barr (1991), no sign of a valley elderberry longhorn beetle population was found in Caswell MSP, where exit holes and adults had been previously reported by Holland (CDFG 1997).

Delta button-celery *(Eryngium racemosum)* is California endangered, federal Species of Concern, and on the CNPS List 1B. Delta button-celery has been recorded from the northeast end of the Park (CDFG 1997).

Northern California black walnut *(Juglans californica* var. *hindsii)* is listed with the California Native Plant Society as a 1B and is a federal Species of Concern. It is a common tree throughout the Park (Quinn and Hrusa 1993).

Cultural Resources

There is little information regarding the cultural resources within Caswell MSP. According to Bill Ray (pers. comm. 1997), at the Central California Information Center, there has been no cultural or historic resources survey of the Park. One prehistoric site is known to exist near the northern boundary midway through the Park, but its condition and exact location are unknown at this time. Anecdotal evidence reveals the possibility of an Indian burial site in an undisclosed area within the Park (K. Martin pers. comm.).

FUELS AND FIRE MANAGEMENT PROGRAM FOR CASWELL MSP

General Considerations

Keeping understory vegetation sufficiently spaced assures each plant gets optimum light,

water, and nutrients (Wright and Bailey 1982). Without fire, forested communities become stagnant and are plagued with overstocking, excessive fuel accumulation, and inadequate reproduction, which in turn encourage disease and insect infestations (Vogel 1971). Biswell (1989) recommended that prescribed fires, carefully planned and set under the proper conditions, be used in wildlands vegetation management.

Historical vegetation management.—Many public land and resource management agencies in California have adopted the definition of natural vegetation as that which existed prior to European settlement. This, according to Blackburn and Anderson (1993), was the vegetation that was used, walked through, talked about, and managed by indigenous Native Americans. Evidence in their volume supports the view that prior to European arrival, Native Americans actively managed their environment throughout the Central Valley of California. Indigenous groups used fire and hand removal of excessive vegetation for stimulating new plant growth, inducing early stages of succession, eliminating competition, reducing disease, and creating and sustaining mosaics of different plant associations with numerous ecotones that were beneficial to animal life.

Though use of fire by California Indians for vegetation management is now very limited, contemporary basket weavers and gatherers continue to practice vegetation management by hand. In some areas, they have gained the cooperation of the U.S. Forest Service to conduct controlled burning for the benefit of specific basketry plant species (S. Nicola., pers. comm.). The California Indian Basketweavers Association (CIBA) stated, "by using methods such as pruning, digging, sowing, burning, and selective harvesting, optimum plant growth and desired characteristics are achieved" (CIBA 1998).

Management Areas within Caswell MSP

Campsites and picnic areas.—CDPR fuel modification policy requires the clearing of excessive vegetation in campsites and picnic areas. This includes removing all downed wood larger than 0.25 inches (0.645 cm) in diameter, pruning dead wood in lower half of shrubs, and removing dead limbs to staggered heights between 6 and 8 feet (1.86-2.44 m; CDPR 1996). Past practice has been to cut and remove this vegetation to a large burn pile in an undeveloped part of the Park where it is burned once a year during late winter or early spring.

Because of Air Quality Management District restrictions and the likelihood of federal listing for the riparian brush rabbit, this practice may no longer be allowed (C. Stokes pers. comm.). Smaller burn piles and the use of a wood chipper will soon replace the large burn pile method within CMSP.

Undeveloped areas.—Areas within CMSP that have not had vegetation management are typically heavily loaded with fine fuels that overlay a thick layer (up to 5 inches [12.7 cm] or more) of duff. Coarse fuels often are still standing, or may have been on the ground so long that they are heavily decayed.

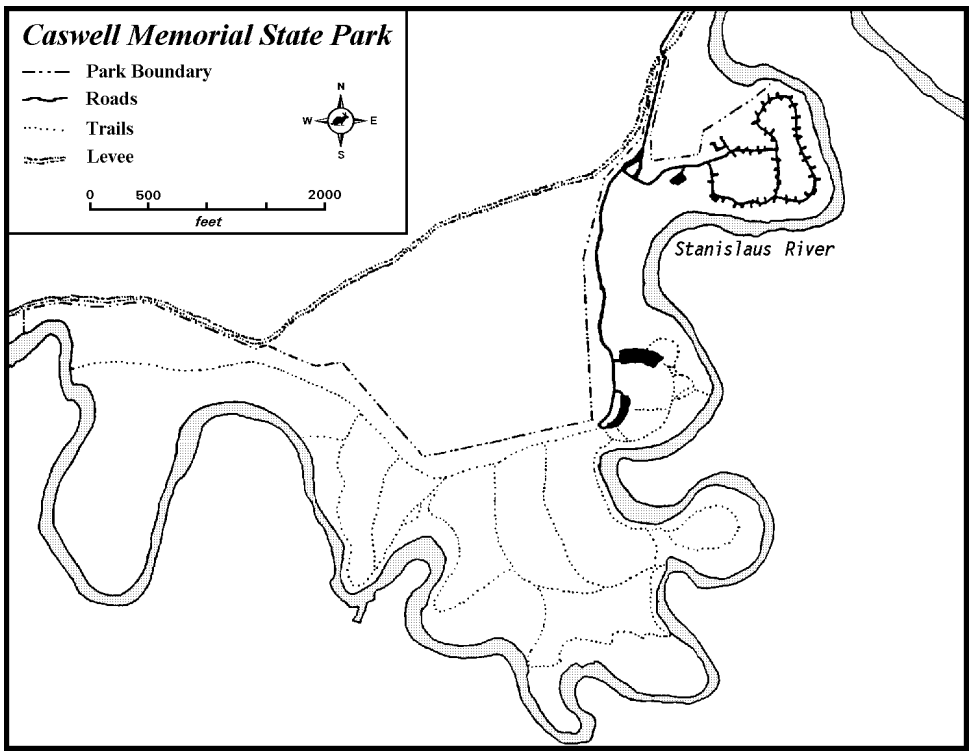


Figure 2. *Map of Caswell Memorial State Park with approximate positions of roads and trails. The Stanislaus River forms the southern boundary of the Park.*

Past policy of CDPR regarding decadent downed and standing material in undeveloped parts of the Park has been to let it lie where it falls, which has led to immense buildup of ground fuels throughout the Park. In light of this, CDPR is working with ESRP, the Ripon CFD, and other agencies to develop a fire and habitat management plan which will address these pertinent issues while providing suitable habitat for endangered and threatened species. CDPR also must fulfill their mandate to provide recreation to the visiting public, so finding the common ground between these objectives is of primary importance. Any fuel management plan within the Park will be a long-term venture, and will require the careful consideration of all park values.

Trail and road fuel breaks.—Fuel breaks are strategically placed strips of low-volume fuels designed to provide attack points, safe access, and reduced fire behavior (CDF 1998*b*). The existing roads and trails within the Park can be used and maintained as fire and fuel breaks (Figure 2). Mowing and clearing of trails and roads is done on a regular basis by CDPR. Trees that have fallen and obstruct roads and trails are cut and removed to the large burn pile. The Ripon Consolidated Fire Department requires access to all parts of the Park in the event of a fire, and considers these areas as the only points from which a safe attack on a fire can be made. Any alterations of existing roads shall require prior CEQA approval (CDPR 1996). Road specifications are outlined in the Wildfire Management Planning

document for California State Park System (CDPR 1996).

Ladder fuels.—Extensive areas of the Park are choked with ladder fuels (vines climbing into the upper canopy of trees). Should a fire start, the vines would carry the fire into the upper canopy of the forest (Frontispiece; Appendix A, Plate 6, p. 35). Crown fires have the potential to spread fire long distances, making fuel breaks ineffective. Crown fires may also increase the likelihood of fire spreading out of the Park and into adjoining properties.

Removing ladder fuels can significantly affect the potential for crown fires, which are extremely difficult to control and often devastating (Dodge 1972). Ethnobotanist Beverly Stevenot (pers. comm.) revealed that native peoples, "in their process of cultivating sedge, were always clearing the blackberries and brambles and would pull the vines out of trees and clear dead, decaying vegetation." Creation of small canopy gaps by overstory manipulations should be done in a patchy, irregular manner to mimic natural disturbances and forest structure (Kauffman et al. 1997).

Smoke and community sensitivity.—A prescribed burn plan must be approved by the San Joaquin Valley Air Quality Management District. CDPR has primary responsibility for writing and submitting the prescribed burn plan for CMSP. Prior notification of prescribed burn plans to individuals that may be smoke sensitive include adjacent neighbors, schools, and housing developments.

Issues and Recommendations for Fuel and Habitat Management

CMSP can be divided into several distinct management zones, each of which may require specialized vegetation and fuel management priorities. A sample unit classification (Figure 3) may be used to designate areas based on previous investigations of the ecology and habitat requirements of the riparian brush rabbit (Williams 1988). Existing trails and roads can be used to identify management units. Tim Neeley (pers. comm.), Park Ecologist for the CDPR, suggests dividing the approximately 140 acres (57 ha) of oak woodland into 9 or 10 plots as defined by the existing trail system. Each of these plots exhibits its own characteristics according to vegetation types and fuel loading.

While the main goal of fuel and habitat management planning is to reduce excessive vegetation and downed woody litter that will contribute to the likelihood of catastrophic fire, other positive effects of habitat restoration may be achieved at the same time. Invasive non-native vegetation can be targeted during the implementation of this plan. Certain areas of the Park support more non-native species than others. For example, the tree of heaven (*Ailanthus altissima),* has become naturalized throughout the Park by sprouting from surface roots and seed dispersal. This tree will eventually out compete all other nearby vegetation (Quinn and Hrusa 1993). An aggressive project to control *A. altissima* was implemented during 1995 by CDPR (Neeley 1997), with favorable results.

Several different methods of vegetation management and fuel reduction may be necessary within Caswell MSP. These are discussed below in the appropriate categories. Which-

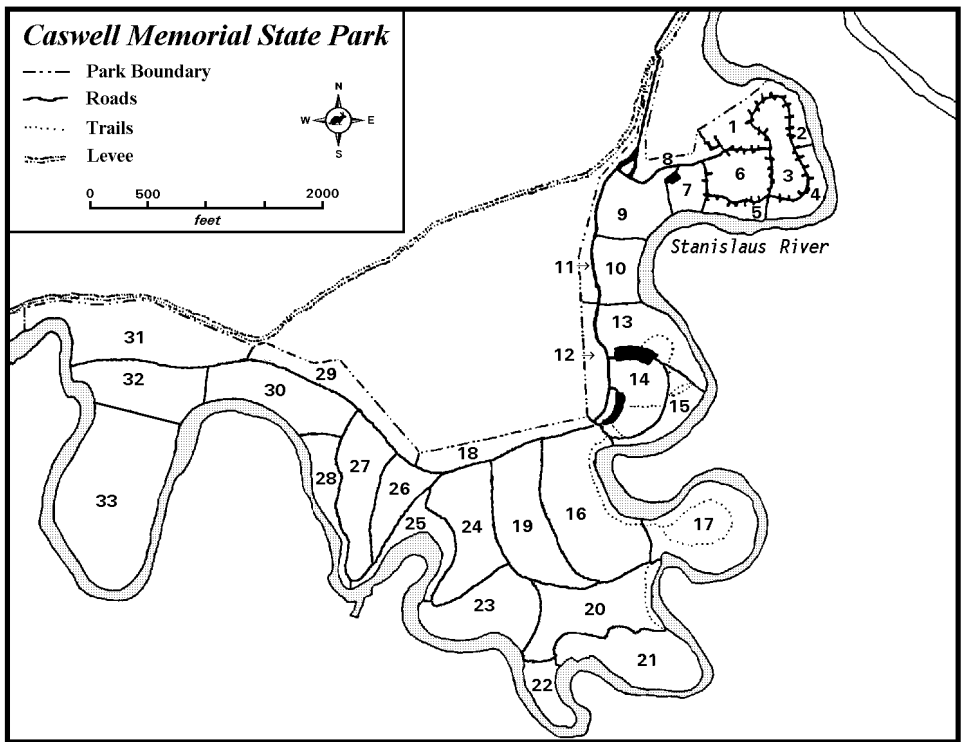


Figure 3. *Potential vegetation management units for Caswell MSP (adapted from Williams 1988).*

ever method or combination of methods is decided upon, the process of vegetation management within the Park will be a continuous, long term project aimed at maintaining a discreet balance between fire control and habitat integrity.

Fuels.—Fuels consist of duff, litter, and downed woody fuels. Downed woody fuels are divided into four fuel classes based on diameters of 0-1/4 inch, 1/4-1 inch, 1-3 inch and > 3 inch (0-6.35 mm, 6.35-25.4 mm, 2.54-6.62 cm, > 7.62 cm). Together with litter, the two smaller classes of woody fuel constitute the primary agent for the spread of low to moderate intensity fire, and are referred to as "fine" fuels. Duff and the two larger classes burn too slowly to play a major role in fire spread, but they do release large amounts of energy during consumption, and can play a major role in plant mortality (Wright and Bailey 1982). Various procedures are available for determining the fuel load of specific areas. They take into account weights and volumes of downed woody material, fuel and duff depth, fuel composition, and structure (arrangement). Personnel within the CDPR will use these calculations and determine the total fuel load and fuel structure, which will result in hand or mechanical removal and burning parameters that will meet their standards for fuel reduction.

Mechanical removal of excess fuels.—Traditional mechanical removal of decadent brush, limbs, and logs using dozers or other large equipment is not appropriate at Caswell MSP. The relatively small area involved, the fragile riparian community, and the presence of threatened and endangered species dictates a small scale vegetation management operation focusing on hand removal and burning of small plots or strips of vegetation. The use

of small-scale mechanical aids such as a "Weed Wrench", shovel, or dig bar can be useful for removing isolated or individual trees or brush.

Fuel reduction by prescribed fire and hand piling.—Prescribed fire may be used to produce and maintain a mosaic of shrub age classes on the landscape that are capable of providing a continual supply of young, vigorous vegetation for animals, with seeds for preferred food supply, and cover for escape, resting, and nesting by wildlife, while providing maximum edge for feeding by brush rabbits.

Because of the unfamiliar fuel type (little research or fire history in riparian communities of the type represented in Caswell MSP is available), the fire manager should supplement prior training by burning a few small test plots based on the best prescribed burning data available (Wright and Bailey 1982). Fire Effects Information Service (FEIS) is a service of the US Department of Agriculture, Forest Service, Intermountain Research Station, and has compiled a limited amount of information on specific plant and animal responses to fire. This information can be found in Appendix C.

Periodic monitoring of treated areas to determine rates of regrowth and level and nature of use by brush rabbits and woodrats will be needed in order to establish a reliable and effective maintenance schedule. A rotation schedule that results in repeated treatment every 15 to 30 years may be required if habitat for brush rabbits is not to be reduced significantly.

According to Biswell (1989), hand piling and spot fires are useful techniques for reducing fuels in strategic areas of forests. He recommended this technique be used in areas where cleanup is necessary after a broadcast burn; however, it may be applicable at Caswell in lieu of broadcast burning, which is not appropriate for such a small park. Hand piling involves burning small piles of fuel, and as the fuels burn, adding more a little at a time to always keep the fires small and easily contained. The piles are placed 5 to 10 feet (1.5-3 m) away from the trunks of trees to prevent scorching. By this method, one energetic person can keep a half dozen piles going at one time and burn 600 to 1,000 pounds of debris per hour. Even though the piles are kept small, fire intensity can be sufficient to prevent much visible smoke (Biswell 1989).

Hand removal.—Hand removal of decadent, but attached twigs and branchwood, downed woody material, and ladder fuels may be the best long-term solution to fuel buildup within the Park. While this may be the most expensive and labor intensive solution, there are several methods that may be employed to mitigate the cost and labor involved in such a long term project.

One method involves the manual removal of material followed by the use of a wood chipper. A chipper will provide the means to dispose of twig and branchwood and reduce the need for piling large amounts of wood and branch material for burning at a later date. The chipped material can then be used in campgrounds and picnic areas, which are prone to compaction and erosion where heavy use has left the areas barren of any litter or duff

layers.

Current CDPR policy prohibits the cutting or removal of wood within Caswell MSP. As one walks around the Park today, the overabundance of downed trees and piled log rounds is alarming. One possible solution to disposing of this wood might be to offer it at a reduced rate to woodcutters, local residents, or campers. This option is an opportunity to involve local residents in the protection of Caswell MSP while fostering an understanding of basic ecosystem management. It is recommended that any extra revenue brought in by the sale of the downed trees be earmarked exclusively for Caswell MSP restoration activities. Supervision by CDPR personnel of any wood removal program by local citizens might also be paid for by funds taken in from the sale of downed logs. Careful supervision of any vegetation removal program is important.

A fine balance between vegetation removal and maintenance of optimum habitat for riparian brush rabbits and woodrats is extremely important. For instance, hollows in logs with openings of less than about 4 inches (10 cm) provide refuge for riparian brush rabbits from larger predators such as gray foxes, coyotes, and feral cats. Logs and downed limbs provide the structure to support vines off the ground, providing covered space on the ground that is essential for protection from extremes of weather and from predators.

Reduction of ladder fuels.—Many of the vines that climb into trees should be removed as part of this vegetation management plan. Hand removal is the only appropriate and feasible way of accomplishing this task. Local school or community groups may be interested in using the vine material to make wreaths or other items that could be sold as fund-raising activities.

Special management areas.—Areas of high ground that are the only refuges for riparian brush rabbits and riparian woodrats during flooding should have corridors of connecting habitat, and the high ground areas should be maintained and excluded from complete vegetation removal.

The delineation of these and other, as yet unidentified special management zones to the Ripon Consolidated Fire District is necessary and was requested in a FAX sent to ESRP on 9/29/97 from Dennis Bitters. The specific request states: “Identify areas of the Park where aggressive firefighting efforts should take place, and ensure proper access to them. Likewise, identify areas where these actions are not appropriate.”

Fire containment.—Existing trails and roads provide access to most parts of the Park, but these are too narrow to provide effective firebreaks and the road in the undeveloped part of the Park is too narrow for safe access by firefighting equipment. Tim Neeley (pers. comm.) suggested clearing wider areas of ground and ladder fuels at strategic points in the Park to serve as fire breaks. These firebreaks would provide access points from which a wildfire could be fought. Because a major wildfire is likely to be too hot and move too fast to “fight” within the dense brush and trees of most of the Park, the primary strategy would be containment. Enlarged firebreaks might give the firefighters access to more remote parts of the Park. Currently it is unlikely that any responding fire department would be able to

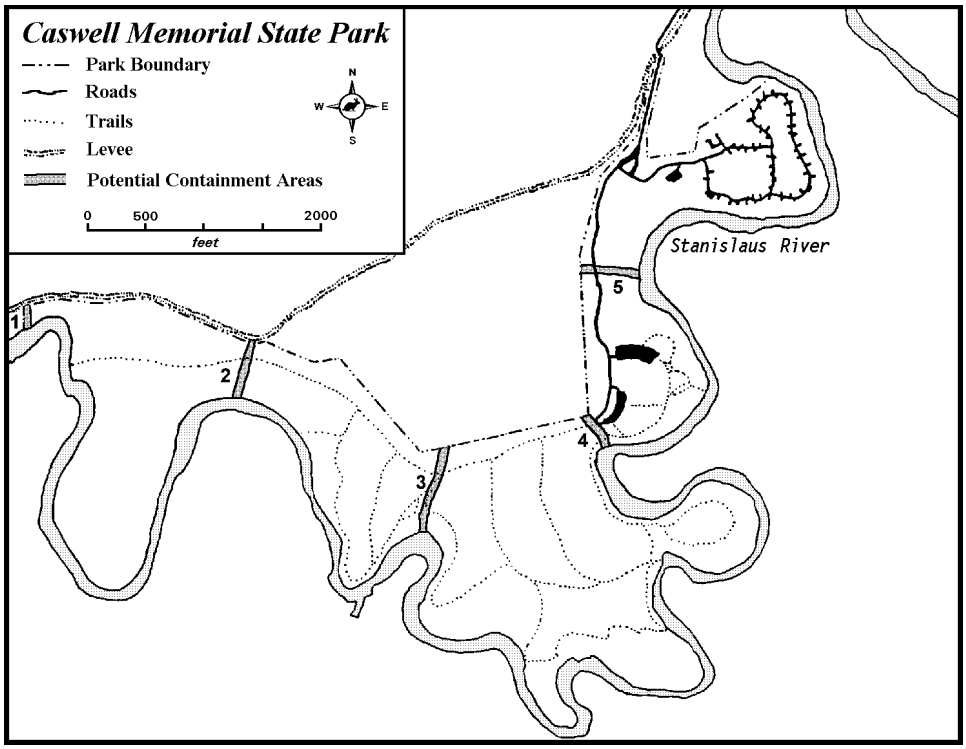


Figure 4. *Map of Caswell MSP showing general locations of potential firebreaks serving as fire containment areas.*

access the Park beyond the paved roads. As part of the post-fire planning process at Bobelain Preserve, resource managers installed a 75 by 900 ft (23 by 275 m) fire break (B. Clark pers. comm.). During the fire season at Caswell MSP, prevailing winds mostly blow from the northwest in a southeasterly direction. In Figure 4 we suggest the general locations for five such containment areas. The actual number, size, and locations of these containment areas should be determined in context with other resource and archaeological issues and firefighting needs.

Gathering of plants by Native Americans.—Increasingly, land managers rely on traditional methods and practices to assist in the development of habitat management planning and ecosystem management techniques. Groups such as CIBA strive to promote education, encourage cooperation, and remove barriers to the traditional practitioners of ecosystem management (S. Nicola pers. comm.). A number of plants growing within Caswell MSP are considered important in traditional economic, medicinal, ceremonial and artistic pursuits. The most significant of these plant resources are the rhizomes or runners of sedges (*Carex* spp. and *Cyperus* spp.). In the process of harvesting the rhizomes, harvesters leave the plants and remove weeds, thereby cultivating the sedge bed and enhancing the habitat for the production of new and healthier growth (K. Stevenot pers. comm.).

In addition to sedges, willows (*Salix* spp.) are commonly used in basket weaving. Through the repeated cutting back of upper branches of the willow plant, growth in under-

ground lateral runners is stimulated. As with the sedge, the cultivation process helps the willow to spread, keeps it from getting top heavy and falling down, removes diseased branches, and increases its effectiveness in controlling erosion along stream banks (Lerner et al. 1982).

Current CDPR regulations limit the access afforded to Native Americans for traditional gathering activities. Gatherers must go through a permit process prior to approval, must pay to enter the Park, and then are limited to a small patch of ground in which they can gather materials. In addition, gathering activities must be conducted out of the view of park visitors, and away from roads, trails, and developed areas. These requirements are regarded both as odious burdens and obstacles to resources that enable continuance of traditional cultural practices (and therefore, the survival of native culture itself). They are also perceived as demeaning and degrading to a people whose land this once was but who now can only use it on somebody else's terms (S. Nicola pers. comm.).

Revision of these policies in consultation with California Indian gatherers with the objectives of promoting gathering of basket materials and cooperative management of native plant sources probably would contribute to resource management objectives. The CDPR could consider eliminating the entrance fee and restrictions on gathering periods and locations for California Indian basket weavers and gatherers for activities the Department determines are beneficial to its management objectives. Entrance fees encourage gatherers to concentrate their gathering in fewer days, thereby possibly negating the positive effect of continuous maintenance of the vegetation. Traditionally, gatherers revisit an area frequently to maintain the region free of weedy species (S. Nicola pers. comm.).

Fire response by Ripon Consolidated Fire Department.—RCFD has responsibility for the initial response to fire, and estimates their arrival time to Caswell from the City of Ripon to be anywhere between 10 to 12 minutes. The only reliable source of water is located at B and B Farms, located about 0.5 mile (0.8 km) away from the Park. The RCFD has a verbal agreement with B and B farm owners that water tenders can fill their tanks from this private water source in an emergency.

Fire Response by CDPR.—Currently, Park employees are not trained in fire response, and have the minimum of equipment to attack a fire should one start in CMSP. The only firefighting equipment at the Park is a 50-gallon tank (189.25 l) mounted on a small trailer that must be attached to a pickup to be moved. This is impractical in the event of a fire because of the critical firefighting time lost in hooking it up to a truck. Park personnel have no firefighting clothing (A. Chavez pers. comm.), and have only small fire extinguishers in their vehicles.

The ability to aggressively attack a vegetation fire in the first few minutes may mean the difference between containment or a catastrophic wildland fire. Given the extreme fuel loading within the Park, the response time of between 10 to 12 minutes of the Ripon Consolidated Fire Department, the occurrence of threatened and endangered species, and the lack of access to reliable water sources within the Park at this time, initial fire response by park

employees may be the deciding factor between containment or catastrophe.

Recommendations derived from discussions between representatives of CDPR, RCFD, and ESRP are:

a. Standardize existing standpipe outlets to a size that will accommodate single-jacket wildland fire hose. At least 100 ft (30.5 m) of hose should be supplied in boxes near the standpipes to enable park personnel to hook up to the available water supply that exists throughout the developed section of the Park.

b. Train park employees in basic firefighting tactics and supply them with the minimum standard firefighting tools.

c. Acquire a "quick attack" or booster hard line(s) mounted on one or more of the vehicles. This would enable park employees to extinguish a fire in its incipient stage. This, in combination with shovels and other basic firefighting tools, would give park employees the opportunity to safely fight a fire until the arrival of the Ripon CFD.

The Ripon Consolidated Fire Department recommendations and advice for Caswell MSP are as follows:

a. Develop and implement a comprehensive fuels management program aimed at reducing the amount of decadent vegetation within the Park as a planning strategy for fire prevention.

b. Inspect periodically and consult with the RCFD to maintain the safest possible firefighting conditions.

c. Maintain fire roads on a regular basis.

d. Notify RCFD of change in conditions within the Park. Such changes might include new ingress or egress, new structures, and changes in fire road accessibility.

e. Provide accurate maps of the Park, including buildings, roads, and trails.

f. Identify areas of the Park where aggressive firefighting efforts should take place, and ensure proper access to them; also identify areas where these actions are not appropriate.

g. Provide a reliable source of water for firefighting purposes; this would include the installation of fire hydrants supplied by "rated fire pumps" capable of 500-1000 gal/min (1,893-3,785 l) with a standby generator or some other source of power. Should rated fire hydrants be installed within the Park, RCFD personnel are more than willing to maintain them in a state of readiness (G. Vander Plaats pers. comm.).

h. Provide additional emergency ingress or egress within the Park. One such improve-

ment would be an agreement with B & B farms to allow emergency equipment to make access into the Park from the adjoining levee at the west end of the Park. Additionally, campsite 17 at the northern end of the campground can easily be converted to allow Park visitors an emergency exit from the campground area via the levee (A. Chavez pers. comm.).

Caswell MSP Water Access Issues and Alternatives

Access to water for fighting fires within the Park is tenuous at best. According to the RCFD, existing wells and pumps within the Park are not capable of supplying the amount of water pressure or volume necessary to fill firefighting equipment during an emergency. Calwater Drilling Co., Inc., is the company that installed the two existing wells in the Park. Based on the well-drillers report and a cursory inspection of the well sites, these wells are not capable of producing sufficient water pressure (B. Hennings pers. comm.). The other immediate source of water to fight a wildland fire is the Stanislaus River. According to the RCFD, this is not an alternative because of inadequate access, the distance of the water from the access points available, and the likelihood of sucking sand into the engine pumps. The river level during much of the year is 8-10 or more feet below the top of the steep or vertical banks, and there are no vehicle access points to the River from the Park

The water from B & B Farms farm owners (Brochinni) is suitable, according to Chief Vander Plaats (pers. comm.), but the nearest hookup point is 0.5 mi from the Park. Also, in the event of sale of the property, or a disagreement with the property owners, the only source of water for fighting fires in the Park could be unavailable. Therefore, we believe it is critically important that a new well or wells be drilled at Caswell MSP that are capable of delivering the volume of water needed for fighting wildland fires, and that pumps, pipes, and hydrants be installed that can deliver water at required pressure to strategic points in the Park as determined by RCFD and CDPR.

Concluding Remarks on Fire Management

While several suggestions have been given to facilitate inter-agency planning and cooperation to prevent the loss of habitat necessary for the survival of the riparian brush rabbit and riparian woodrat, many other important alternatives may be available. Most important at this time is the cooperative nature of preplanning. By necessity, this requires resource advisors and land managers establish and maintain a communication link with fire response teams prior to an emergency as well as during an incident. Should a fire erupt at Caswell MSP, a State Park ecologist familiar with the threatened and endangered species at the Park should be notified as soon as possible. In addition, timely notification of personnel within the California Department of Fish and Game and the Endangered Species Recovery Program may benefit fire recovery of animals during the incident. Sheppard and Farnsworth (1995, p. 338) wrote:

As a minimum, this individual (resource advisor) needs to be knowledgeable of the

Incident Command System, familiar and comfortable with the fire environment, and knowledgeable of the resources that may be impacted by the fire and suppression actions. The resource advisor should also be delegated full authority as the agency representative or have a direct link to the line officer. It is important to have a resource advisor available at the earliest point in the wildfire incident that threatens threatened and endangered species habitat.

FLOOD MANAGEMENT PROGRAM

The completion of New Melones Dam in the 1970's significantly lessened the frequency of flooding at Caswell MSP and other areas downstream from the Dam on the Stanislaus River. Yet, it also made more intensive agriculture close to the river economically viable, which resulted in loss of habitat for animals escaping from high water. Also, the Dam and flood control levees have actually increased the severity of flooding in the remaining riparian communities. There now are essentially no places other than the levee tops that animals living within this flood channel can escape from high water, and levees mostly are maintained free of vegetation. Thus, animals that might make it to high ground on levees during flood have no cover to escape from predators and inclement weather and no food to sustain them.

Options for Flood Refugia

Protecting human lives and property take precedence over endangered species and natural communities when considering flood management options. The only options to protect terrestrial animals from floods within Caswell MSP are to construct elevated sites in strategic areas within or next to the Park and to ensure that adequate cover is available in these areas and on the levees. We believe the ultimate solution to protection of these animals from the effects of flooding may be found outside of the Park. The issues concerning in-park flood protection must be considered and resolved before any decisions can be made about the efficacy of building flood refugia within the Park. For example, it may be more practical and cost effective to build elevated ground at the San Joaquin River National Wildlife Refuge. Regardless of what transpires at Caswell MSP, the recovery of riparian brush rabbit and woodrat populations will require protecting and restoring additional habitat areas within their historical geographic range (Williams et al. 1997).

Elevated mounds within CSMP.—Location, composition, and configuration of mounds must be such that they are not subjected to severe erosion from flowing water nor cause currents to be defected into levees in a way that might erode or weaken them. Deciding these issues will require the involvement of COE, affected levee maintenance entities, landowners with property adjacent to the Park, CDPR, and probably other entities. In areas of the Park that border the levee, mounds extending from the levee and angled in a downstream direction could serve as refuges and probably would not compromise levee integrity. In other areas, oval mounds with their long axes oriented in the direction of water flow probably would best withstand water currents.

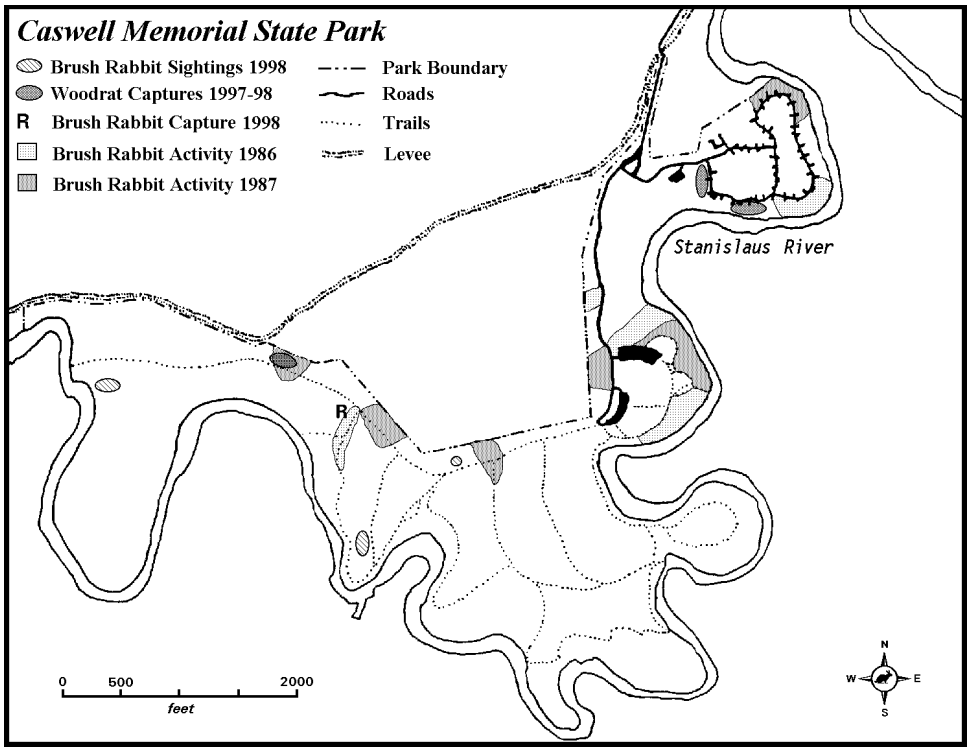


Figure 5. *General locations of sightings, captures, and sign of activity of brush rabbits and captures of woodrats. Data for 1986 and 1987 are adapted from Williams (1988). Data for 1997-98 are from field work by ESRP.*

In locating areas to be elevated within the Park, consideration also must be given to the effects that mounding soil will have on existing plants and animals, archaeological resources, and park uses. Archaeological resources have not been surveyed, so potential conflicts cannot be determined now. Also, still to be determined are source and cost of dirt needed to construct mounds, source of funds for the construction, and the size and number of mounds needed. Based on prior research, focused mostly on riparian brush rabbits, we believe that from 6 to 12 or more mounds, scattered over the Park, will be needed.

Elevated sites need to be located strategically in or next to areas that typically support the greatest numbers of brush rabbits and woodrats. Figure 5 shows areas of greatest abundance of brush rabbits following a major flood in winter 1986 and one year after flooding (Williams 1988). Also shown are areas of sightings and capture of brush rabbits in 1998 and captures of woodrats in 1997-1998. Caswell MSP experienced a major flood in January 1997.

Mounds should be located such that they connect the higher areas within the Park that are not inundated during moderate flooding (Figure 6). They would increase the amount of ground above flood waters and provide corridors to move between patches of dry ground. Downed woody material should be piled at several places on newly-constructed mounds to

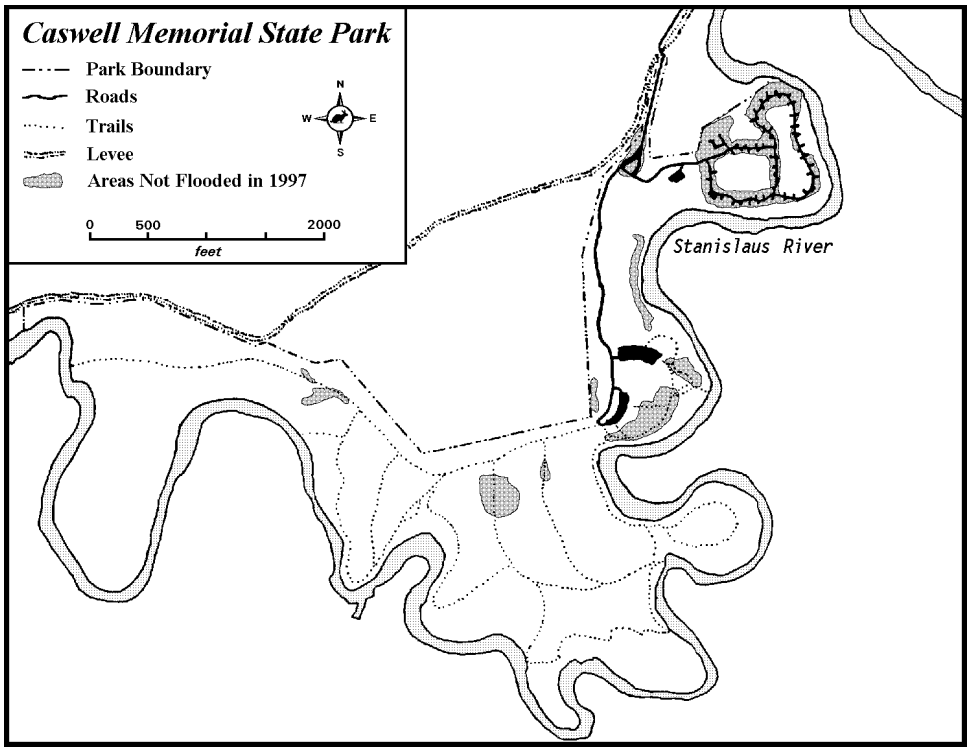


Figure 6. *General locations of areas not flooded during the flood of January 1997.*

provide cover until natural vegetation becomes well established. Natural vegetation, including preferred cover and food plants of riparian brush rabbits and woodrats should be established as soon as possible after construction of mounds.

Population densities of brush rabbits and woodrats have varied within different areas of the Park, apparently in response to prior flooding and probably because of other, unidentified factors (Williams and Basey 1986, Williams 1998, Cook and Quinn 1992, Williams 1993). Although, historical data provide one basis for positioning mounds, we believe it is premature to identify potential sites for constructing elevated mounds until the affected parties are brought together, identify potential constraints, and agree on a course of action.

Cover and food on levees.— Wildlife protection agencies should explore with affected landowners and flood-protection entities mechanisms to provide support for farmers and levee maintenance entities for creating conditions on levees conducive to refuging brush rabbits. Local levee maintenance entities should be encouraged to and assisted in providing cover for animals during floods.

Currently, levees are kept relatively free of any vegetation through the use of herbicides. Placing short sections (3-6 ft, 0.93-1.85 m) of 4-6-inch (10-15 cm) diameter concrete pipe along the upper sides and tops of levees and planting perennial grasses on the tops and sides of levees would provide some cover and food for brush rabbits that were forced to refuge from high water. Small piles of tree prunings also could serve as cover for brush rabbits. The

grasses also would slow erosion and reduce the need to treat levees with herbicides.

COST ESTIMATES FOR FIRE AND FLOOD CONTROL

Costs, responsibile entities, potential partners, and implementation time for activites associated with fire and flood control listed in the preceeding sections are given in Table 1 and further discussed in the following paragraphs.

Wells.—A 300 ft (91.5 m) well with a casing of 12.75 inch (32.4 cm) would be capable of 1000-1,200 gpm output. The cost estimate from Calwater Drilling, Inc., for the well was about $27,000 (B. Hennings pers. comm.). Two separate estimates were received from I.J. Larsen Pumps, Inc. in Modesto for the cost of the pumps. Option one would provide 600 gpm from a 15 horsepower submersible pump, at a cost of about $6,526. Option two would provide 1,000 gpm from a 30 horsepower submersible pump at a cost of about $8,164. The estimates for both pump options covers material in the well and the pump control panel only. It does not include the labor or the electrical permit, discharge material, or electrical service. Labor for these activities is estimated at $10,000.

Water tanks.—Estimates for polyethylene water tanks were obtained from B & H Tank Works, Inc. An above ground, 4,600-gallon (17,411-l) tank 90 inches (2.28 m) in diameter, and 15 ft (4.58 m) tall was approximately $2,789. A 6,900-gallon (26,117-l) tank was approximately $4,000 and a 12,500-gallon (47,313-l) tank cost about $12, 894. The major drawback to investing in a water tank as the only fire-fighting improvement for the Park is that once the tank is drained of water during an emergency, the initial problem of poor water pressure and existing well capacity will delay the water tank replenishment. Water storage tanks are not a cost-effective method for protecting the Park from a major wildfire, but figures are presented here comparison as an alternative to a new well and water lines.

Water line, hydrants, and hose.—Estimates for a new water line was $30/ft for 5,000 ft of line, for a total cost of $150,000. Hydrants and associated plumbing are estimated at $3,000. Estimated total cost to standardize and equip existing standpipes in the Park is $7,545.

REFERENCES

Table 1. *Implementation table for fire and flood protection at Caswell MSP.*

Priority	Task Description	Duration	Active Partners with CDPR	Cost Estimate	Comments
1	Construct emergency ingress/egress road from campground at east end of park	1 month (construction); 6 months (easement agreement, engineering)	RCFD: Advisement on placement and width. B & B Frams: easement/right of way agreement.	TBD	Road probably would be on existing levees
2	Create/improve strategic areas to serve as access and staging for fire containment efforts	3 months	RCFD: Advisement on placement of areas. ESRP: Survey and assessment of area for sensitive species.	$10,000	Any excavation will require prior biological and archeological surveys
3	Reduce fuel loading in specific areas of park through hand and mechanical removal and prescribed burning	ongoing with more intensive initial activity	RCFD: Assistance in prescribed burning. SJV Air Pollution control District: permit for burning. ESRP: Survey of target areas for sensitive species.	CCC crew for1 week: $5,000. Park staff (1): $350. Equipment: $980	Wood chipper is necessary for burn plot preparation. Equipment: Power pruner, 51" chain saw
4	Standardize existing standpipes to accomodate wildland hose and supply 100 ft of hose at standpipes	2 months	CVPIA CP (BR, FWS): grant to CDPR	$7,545	
5	Train and equip park personnel with basic firefighting skills and equipment	1 week	CDF: firefighting training.	Training: TBD Equipment: $1,000	
6	Purchase quick attack or hard line and mount on park vehicle	1 month	CVPIA CP (BR, FWS): grant to CDPR	TBD	
7	Periodically inspect Park and consult between RCFD and CDPR	ongoing	RCFD: Periodic inspection of the park water supply and consultation on maintenance of staging areas and ingress/egress conditions	No Charge	Inspection and testing of water lines annually
8	Provide adequate water source for fighting fires	1 year	CVPIA CP (BR, FWS): grant to CDPR.	Well: $27,000 Pump: 1,000 gpm, $8,164 Water Line: $30/ft @ 5,000 ft, $150,000 Hydrants and T's: $3,000 Total: $188,164	
9	Monitor biota's response to vegetation management	ongoing	ESRP: Monitor riparian brush rabbits and woodrats.	$15,000	Periodic monitoring annually for 3-5 years
10	Locate and map areas for refuge mounds	2 months	ESRP & COE: Refugia design and placement.	$6,000	
11	Determine cost and feasibility of constructing rmounds	3 months	ESRP, CDFG, COE, BR, FWS	$4,000	
12	Review park policies regarding gathering of basket-weaving materials by Native Americans	1 month	CIBA	$1,000	.

References Cited

Barr, C.B. 1991. The distribution, habitat, and status of the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus)*. U.S. Fish and Wildlife Service, Sacramento, CA, 134 pp.

Biswell, H.H. 1989. Prescribed burning in California: wildlands vegetation management. University of California Press, Berkeley and Los Angeles, 255 pp.

Blackburn, T.C., and K. Anderson. 1993. Before the wilderness: environmental management by Native Californians. Ballena Press, Menlo Park, CA, 476 pp.

California Department of Fish and Game. 1997. California Natural Diversity Database. Sacramento, Electronic form.

California Department of Forestry. 1998*a*. California fire service and rescue emergency mutual aid plan (Fire and Rescue Service Advisory Committee/FIRESCO Board of Directors, eds.). Sacramento, CA, 36 pp.

California Department of Forestry. 1998*b*. Prefire effectiveness in fire management—a summary of state-of-knowledge. CDF Fire and Resources Program. Internet online. 3 January. Available: frap.cdf.ca.gov/assessment/index.html.

California Department of Parks and Recreation. 1996. Wildfire management planning—guidelines and policy. Sacramento, CA, 58 pp.

California Indian Basketweavers Association. 1998. Internet online. 22 April. Available: www.ciba.org/ciba/.

Cook, R.R., and J.F. Quinn. 1992. An inventory of the mammals of Caswell Memorial State Park with special attention to the riparian brush rabbit (*Sylvilagus bachmani riparius)* and riparian woodrat (*Neotoma fucipes riparia)*. California Dept. Parks and Recreation, Lodi, Final Rep., 30 pp.

Dodge, M. 1972. Forest fuel accumulation—a growing problem. Science 177:139-142.

Elems, S., and J. Medeiros. 1977. Flora and fauna of Caswell Memorial State Park. Great Valley Museum at Modesto Junior College, Modesto, CA, Regional Biota Series ; 1:1-28.

Fire Effects Information Service. 1998. n. page Online. Internet. 14 April. Available: www.fs.fed.us/database/feis.

Kauffman, J.B., R.L. Beschta, N. Otting, and D. Lytjen. 1997. An ecological perspective of riparian and stream restoration in the western United States. Fisheries, Special issue

on Watershed Restoration 22(5), 12 pp.

Larsen, C. J. 1993. Status review of the riparian brush rabbit *(Sylvilagus bachmani riparius)* in California. Nongame Bird and Mammal Section Report 93-12:1-23.

Lerner, R.N., D.W. Peri, S.M. Patterson, and J.L. Goodrich. 1982. Ethnobotanical mitigation, Warm Springs Dam-Lake, Sonoma, CA. Prepared by Elgar Hill, Environmental Analysis & Planning, Penngrove, CA. July, 2nd Printing, May 1983. 135 pp.

Lowe, P.O., P.F. Folliott, J.H. Dieterick, D.R. Patton. 1978. Determining potential wildlife benefits from wildfire in Arizona ponderosa pine forests. USDA Forest Service, Gen. Tech. Rep. RM-52:1-12.

Lugo, A.E. 1995. Fire in wetlands: a management perspective. Proceedings Tall Timbers Fire Ecology Conference, 19:1-9.

Marshall, J.T., Jr. 1963. Fire and birds in the mountains of southern Arizona. Proceedings Tall Timbers Fire Ecology Conference 2:135-141.

Martin, R.E. and D.B. Sapsis. 1992. Fires as agents of biodiversity: pyrodiversity promotes biodiversity. Pp. 150-157, *in* Proceedings of the Symposium on Biodiversity of Northern California (H.M. Kerner, ed.). Univ. California, Berkeley.

Meese, R.J. 1992. Results of bird surveys of Caswell Memorial State Park. California Dept. Parks and Recreation, Lodi, Final Rep., 27 pp.

Neeley, T. 1997. Completion report for Caswell MSP exotic species removal, (*Ailanthus altissima).* California Dept. Parks and Recreation, Gustine, CA, 5 pp.

Price, M.V., W.M. Nickolas., K.E. Taylor, and K.L. Pluff. 1995. Fire as a management tool for Stephen's kangaroo rat and other small mammal species. Pp. 51-61, *in* Brushfires in California wildlands: ecology and resource management (J.E. Keeley and T. Scott, eds.). International Association of Wildland Fire, Fairfield, WA, 220 pp.

Quinn, J.F., and F.G. Hrusa. 1993. The vascular plants of Caswell Memorial State Park, San Joaquin County, California. Univ. California, Davis, September, 81 pp.

Rothermel, R.C. 1991. Predicting behavior and size of crown fires in the northern Rocky Mountains. USDA Forest Service Res. Paper, INT-438:1-46.

Ryan, K.C., and N.V. Voste. 1985 Evaluating prescribed fires. Pp. 230-238, *in* Proceedings of symposium and workshop on wilderness fire (J.E. Lotan, B.M. Kilgore, W.C. Fischer, and R.W. Mutch, eds.). USDA Forest Service, Gen. Tech. Rep. INT-182:1-434.

Sapsis, D.B., and R.E. Martin. 1994. Fire, the landscape, and diversity: a framework for

managing wildlands. Pp. 270-278, *in* Proceedings of the 12th conference on fire and forest meteorology. Society of American Foresters, Bethesda, MD, 796 pp.

Sauvajot, R.M. 1995. Conservation science in fire-prone natural areas. Pp. 11-19, *in* Brushfires in California wildlands: ecology and resource management (J.E. Keeley and T. Scott, eds.). International Association of Wildland Fire, Fairfield, WA, 220 pp.

Sheppard, G., and A. Farnsworth. 1995. Fire suppression in threatened, endangered, and sensitive species habitats. Pp. 336-340, *in* Proceedings of conference on fire effects on rare and endangered species and habitats (J.M. Greenlee, ed.). International Assoc. of Wildland Fire, Coeur d'Alene, ID, 343 pp.

Schlorff, R. W. and P.H. Bloom. 1984. Importance of riparian systems to nesting Swainson's hawks in the Central Valley of California. Pp. 612-618, *in* California riparian systems: ecology, conservation, and productive management (R.E. Warner and K.M. Hendrix, eds.). Univ. California Press, Berkeley, 1,035 pp.

Springer, P.F., and M.A. Gregg. 1992. Wintering ecology of Aleutian Canada geese *(Branta canadensis leucopareia)* in the San Joaquin Valley, California. Pp. 263-270, *in* Endangered and sensitive species of the San Joaquin Valley, California: their biology, management, and conservation (D.F. Williams, S. Byrne, and T.A. Rado, eds.). The California Energy Commission, Sacramento, 388 pp.

Strahan, J. 1984. Regeneration of riparian forests of the Central Valley. Pp. 58-65, *in* California riparian systems: ecology, conservation, and productive management (R.E. Warner and K.M. Hendrix, eds.). Univ. California Press, Berkeley, 1,035 pp.

United States Department of Agriculture. 1988. Soil Conservation Service. Soil Survey of San Joaquin County, California. Washington, DC, 480 pp.

United States Bureau of Reclamation. 1998. Title 34 of PL 102-575. Internet Online. Available: http://www.mp.usbr.gov/cvpia/title34.html.

United States Fish and Wildlife Service. 1997. Endangered and threatened wildlife and plants; proposed endangered status for the riparian brush rabbit and riparian woodrat. Federal Register, 61:62276-62282.

United States National Weather Service. 1997. FAX information about Ripon, CA area weather, 15 Oct. 1997.

Vogel, X. 1971. The future of our forest. Ecology Today, 1(1):6-8.

Willard, E.E., R.H. Wakimoto, and K.C. Ryan. 1993. Vegetation recovery in sedge meadow communities within the red bench fire, Glacier National Park. Proceedings Tall Timbers Fire Ecology Conference, 19:102-110.

Williams, D.F. 1986. Mammalian species of special concern in California. California Dept. Fish and Game, Wildl. manage. Div., Admin. Rep., 86-1:1-112.

Williams, D.F. 1988. Ecology and management of the riparian brush rabbit in Caswell Memorial State Park. California Dept. Parks and Recreation, Inland Region, Final Report, Interagency Agreement 4-305-6108, 38 pp.

Williams, D.F. 1993. Population censuses of riparian brush rabbits and riparian woodrats at Caswell Memorial State Park during January 1993. Final Report, California Dept. of Parks and Recreation, Lodi, CA, 15 pp.

Williams, D.F., and G.E. Basey. 1986. Population status of the riparian brush rabbit, *Sylvilagus bachmani riparius*. California Dept. Fish and Game, Sacramento, Wildl. Manage. Div., Nongame Bird and Mammal Section, Contract Final Report, 21 pp.

Williams, D.F., J. Verner, H.F. Sakai, and J.R. Waters. 1992. General biology of major prey species of the California spotted owl. USDA Forest Service Gen. Tech. Rep., PSW-GTR-133:207-221.

Williams, D.F., E.A. Cypher, P.A. Kelly, N. Norvell, C.D. Johnson, G.W. Colliver, and K.J. Miller. 1997. Draft recovery plan for upland species of the San Joaquin Valley, California. U.S. Fish and Wildlife Service, Region 1, Portland, OR, 294 pp.

Wirtz, W.O. 1995. Responses of rodent populations to wildfire and prescribed fire in southern California chaparral. Pp.63-67, *in* Brushfires in California wildlands: ecology and resource management (J.E. Keeley and T. Scott, eds.). International Association of Wildland Fire, Fairfield, WA, 220 pp.

Wright, H.A., and A.W. Bailey. 1982. Fire ecology: United States and southern Canada. John Wiley & Sons, Inc., New York, NY, 501 pp.

Personal Communications

Bitters, Dennis. Ripon Consolidated Fire District, Ripon, CA.

Chavez, Al. California Department of Parks and Recreation, Caswell MSP. Ripon, CA.

Clark, Bill. Audubon Bobelaine Sanctuary, Sacramento, CA.

Hamilton, Laurissa. Endangered Species Recovery Program, Fresno, CA.

Hennings, Blake. Calwater Drilling Company, Turlock, CA.
Jacquier, Jake. California Dept. of Parks and Recreation, Turlock Lake, CA.

Martin, Ken. Former park ranger-California Department of Parks and Reclamation, Modesto, CA.

National Weather Service; faxed information re: Ripon, CA,10/15/97.

Neeley, Tim. California Department of Parks and Recreation, Gustine, CA.

Nicola, Steve. California Indian Basketweavers Association, Nevada City, CA.

Reeve, Harold. Audubon Society. Modesto, CA.

Stevenot, Beverly. California Indian Basketweavers Association, Modesto, CA.

Stokes, Chris. California Department of Parks and Recreation. Gustine, CA.

Vander Plaats, Gene. Ripon Consolidated Fire District. Ripon, CA.

APPENDIX B

APPENDIX A

Photographs

Plate 1. *Mature valley oak forest at Audubon's Bobelaine Sactuary. Understory includes California grape, poison oak, blackberries, and other shrubs and herbaceous plants. Photo taken prior to 1992 fire. Photo by Bill Clark.*

Plate 2. *Mature Valley Oak forest at Bobelaine Sactuary after the 1992 fire. Note the mix of dead snags, live trees, and the dominant ground cover of grasses and forbs. Grape and blackberry vines profusely invaded areas without a tree canopy. Photo by Bill Clark.*

Plate 3. *Huge masses of vines and ladder fuels at Caswell MSP. Photo by Connie Lee Close taken in winter when most leaves had dropped.*

Plate 4. *Caswell MSP during summer showing extensive cover of vines. Note vines in tree in background. Photo by Laurissa Hamilton.*

Plate 5. *Flood level in Caswell MSP in spring 1998. Note flood line on vegetation on the south side of the Stanislaus River (red arrow). Photo by Connie Lee Close.*

Plate 6. *Trunk of an oak tree soon after fire. The fire raced up the grape and poison oak vines so fast that little damage was done to the trunk. Photo by Bill Clark.*

Quadruped Animal Species Observed at Caswell Memorial State Park

Lists of quadruped vertebrate species from Caswell MSP were assembled from the following sources: Elems and Medeiros (1977), Williams and Basey (1986), Williams (1988), Cook and Quinn (1992), Meese (1992), Williams (1993), and unpublished observations by D.F. Williams over several years and the staff of ESRP during fieldwork since January 1993. Elems and Medeiros (1977) also provided lists of plant and fish species noted in the Park. Special status species are those accorded special protection under state or federal endangered species acts and those designated as Species of Concern by the state or federal governments. Non-native species are labeled "introduced." Special status codes are:

Introduced	I
California Species of Concern	CSC
California Threatened	CT
California Endangered	CE
Federal Candidate For Listing	FC
Federal Threatened	FT
Federal Endangered	FE
Federally Proposed for Listing	FP

Amphibians

Common Name	Scientific Name	Special Status
California slender salamander	*Batrachoseps attenuatus*	
tiger salamander	*Ambystoma tigrinum*	FC
bullfrog	*Rana catesbiana*	I
Pacific treefrog	*Hyla regilla*	
western spadefoot toad	*Spea hammondi*	CSC
western toad	*Bufo boreas*	

Reptiles

common garter snake	*Thamnophis sirtalis*
gopher snake	*Pituophis melanoleucus*
kingsnake	*Lampropeltis getulus*
western aquatic garter snake	*Thamnophis couchi*
western fence lizard	*Sceloporus occidentalis*
coast horned lizard	*Phrynosoma coronatum*
side-blotched lizard	*Uta stansburiana*
Gilbert's skink	*Eumeces gilberti*
western pond turtle	*Clemmys marmorata*

Mammals

opossum	*Dideplphis virginaina*	I
big brown bat	*Eptesicus fuscus*	
broad-handed mole	*Scapanus latimanus*	
ornate shrew	*Sorex ornatus*	
black-tailed hare	*Lepus californicus*	
desert cottontail	*Sylvilagus audubonii*	
riparian brush rabbit	*Sylvilagus bachmani riparius*	SE, FP
southwestern pocket gopher	*Thomomys bottae*	
California ground squirrel	*Spermophilus beecheyi*	
western gray squirrel	*Sciurus griseus*	
beaver	*Castor canadensis*	
western harvest mouse	*Reithrodontomys megalotis*	
deer mouse	*Peromyscus maniculatus*	
riparian woodrat	*Neotoma fuscipes riparia*	CSC, FP
California vole	*Microtus californicus*	
muskrat	*Ondatra zibethicus*	
house mouse	*Mus musculus*	I
black rat	*Rattus rattus*	I
Norway rat	*Rattus norvegicus*	I
coyote	*Canis latrans*	
gray fox	*Urocyon cinereoargenteus*	
raccoon	*Procyon lotor*	
long-tailed weasel	*Mustela frenata*	
mink	*Mustela vison*	
striped skunk	*Mephitis mephitis*	
spotted skunk	*Spilogale gracilis*	
river otter	*Lontra canadensis*	
feral cat	*Felis sylvestris*	I
mule deer	*Odocoileus hemionus*	

Birds

Family Podicipedidae	
pied-billed grebe	*Podilymbus podiceps*
Family Phalacrocoracidae	
double-crested cormorant	*Phalacrocorax auritus*
Family Ardeidae	
great blue heron	*Ardea herodias*
green heron	*Butorides striatus*
great egret	*Casmerodius albus*

black-crowned night-heron	*Nycticorax nycticorax*	
Family Anatidae		
Canada goose	*Branta canadensis (leucopareia)*	FT
snow goose	*Chen caerulescens*	
mallard	*Anas platyrhynchos*	
green-winged teal	*Anas crecca*	
American wigeon	*Anas americana*	
northern shoveler	*Anas clypeata*	
wood duck	*Aix sponsa*	
Family Cathartidae		
turkey vulture	*Cathartes aura*	
Family Accipitridae		
black-shouldered kite	*Elanus caeruleus*	
Cooper's hawk	*Accipiter cooperii*	
sharp-shinned hawk	*Accipiter striatus*	
red-shouldered hawk	*Buteo lineatus*	
Swainson's hawk	*Buteo swainsoni*	CT
red- tailed hawk	*Buteo jamaicensis*	
rough-legged hawk	*Buteo lagopus*	
golden eagle	*Aquila chrysaetos*	
bald eagle	*Halieaeetus leucocephalus*	CE, FT
northern harrier	*Circus cyaneus*	
osprey	*Pandion haliaetus*	
Family Falconidae		
American kestrel	*Falco sparverius*	
Family Phasianidae		
California quail	*Callipepla californica*	
ring-necked pheasant	*Phasianus colchicus*	I
Family Gruidae		
sandhill crane	*Grus canadensis*	CT
Family Rallidae		
American coot	*Fulica americana*	
common moorhen	*Gallinula chloropus*	
Family Charadriidae		
killdeer	*Charadrius vociferus*	
Family Scolopacidae		
common snipe	*Gallinago gallinago*	
spotted sandpiper	*Actitis macularia*	
least sandpiper	*Calidris minutilla*	
whimbrel	*Numenius phaeopus*	
Family Laridae		
ring-billed gull	*Larus delawarensis*	
California gull	*Larus californicus*	
Family Columbidae		
band-tailed pigeon	*Columba fasciata*	

rock dove	*Columbia livia*	I
mourning dove	*Zenaida macroura*	
Family Cuculidae		
yellow-billed cuckoo	*Coccyzus americanus*	CE
Family Tytonidae		
barn owl	*Tyto alba*	
Family Strigidae		
northern pygmy owl	*Glaucidium gnoma*	
short-eared owl	*Asio flammeus*	
long-eared owl	*Asio otus*	
western screech-owl	*Otus kennicottii*	
great horned owl	*Bubo virginianus*	
Family Apodidae		
Vaux's swift	*Chaetura vauxi*	
Family Trochilidae		
black-chinned hummingbird	*Archilochus alexandri*	
Anna's hummingbird	*Calypte anna*	
rufous hummingbird	*Selasphorus rufus*	
Family Alcedinidae		
belted kingfisher	*Ceryle alcyon*	
Family Picidae		
common flicker	*Colaptes auratus*	
downy woodpecker	*Picoides pubescens*	
Nuttall's woodpecker	*Picoides nuttallii*	
hairy woodpecker	*Picoides villosus*	
acorn woodpecker	*Melanerpes formicivorus*	
red-breasted sapsucker	*Sphyrapicus ruber*	
Family Tyrannidae		
western kingbird	*Tyrannus verticalis*	
Cassin's kingbird	*Tyrannus vociferans*	
Say's phoebe	*Sayornis saya*	
black phoebe	*Sayornis nigricans*	
ash-throated flycatcher	*Myiarchus cinerascens*	
western wood-pewee	*Contopus sordidulus*	
pacific-slope flycatcher	*Empidonax difficilis*	
olive-sided flycatcher	*Contopus borealis*	
Family Alaudidae		
horned lark	*Eremophila alpestris*	
Family Hirundinidae		
violet-green swallow	*Tachycineta thalassina*	
tree swallow	*Tachycineta bicolor*	
northern rough-winged swallow	*Stelgidopteryx serripennis*	
barn swallow	*Hirundo rustica*	
cliff swallow	*Hirundo pyrrhonota*	
bank swallow	*Riparia riparia*	CT

Family Corvidae		
yellow-billed magpie	*Pica nuttalli*	
scrub jay	*Aphelocoma coerulescens*	
American crow	*Corvus brachyrhynchos*	
Family Paridae		
plain titmouse	*Parus inornatus*	
Family Aegithalidae		
bushtit	*Psaltriparus minimus*	
Family Sittidae		
white-breasted nuthatch	*Sitta carolinensis*	
Family Certhiidae		
brown creeper	*Certhia americana*	
Family Troglodytidae		
Bewick's wren	*Thryomanes bewickii*	
house wren	*Troglodytes aedon*	
winter wren	*Troglodytes troglodytes*	
marsh wren	*Cistothorus palustris*	
Family Muscicapidae		
wrentit	*Chamaea fasciata*	
ruby-crowned kinglet	*Regulus calendula*	
golden-crowned kinglet	*Regulus satrapa*	
blue-gray gnatcatcher	*Polioptilla caerulea*	
western bluebird	*Sialia mexicana*	
hermit thrush	*Catharus guttatus*	
Swainson's thrush	*Catharus ustulatus*	
American robin	*Turdus migratorius*	
varied thrush	*Ixoreus naevius*	
Family Mimidae		
northern mockingbird	*Mimus polyglottos*	
California thrasher	*Toxostoma redivivum*	
sage thrasher	*Oreoscoptes montanus*	
Family Motacillidae		
water pipit	*Anthus spinoletta*	
Family Bombycillidae		
cedar waxwing	*Bombycilla cedrorum*	
Bohemian waxwing	*Bombycilla garrulus*	
Family Laniidae		
loggerhead shrike	*Lanius ludovicianus*	
Family Sturnidae		
European starling	*Sturnus vulgaris*	I
Family Vireonidae		
solitary vireo	*Vireo solitarius*	
warbling vireo	*Vireo gilvus*	
Bell's vireo	*Vireo bellii*	FT
Hutton's vireo	*Vireo huttoni*	

Family Emberizidae	
orange-crowned warbler	*Vermivora celata*
yellow warbler	*Dendroica petechia*
yellow-rumped warbler	*Dendroica coronata*
black-throated gray warbler	*Dendroica nigrescens*
Townsend's warbler	*Dendroica townsendi*
Hermit warbler	*Dendroica occidentalis*
MacGillivray's warbler	*Oporornis tolmiei*
Wilson's warbler	*Wilsonia pusilla*
Canada warbler	*Wilsonia canadenis*
common yellowthroat	*Geothlypis trichas*
yellow-breasted chat	*Icteria virens*
western tanager	*Piranga ludoviciana*
black-headed grosbeak	*Pheucticus melanocephalus*
rufous-sided towhee	*Pipilo erythrophthalmus*
California towhee	*Pipilo crissalis*
song sparrow	*Melospiza melodia*
northern oriole	*Icterus galbula*
summer tanager	*Piranga rubra*
Lincoln's sparrow	*Melospiza lincolnii*
grasshopper sparrow	*Ammodramus savannarum*
vesper sparrow	*Pooecetes gramineus*
sage sparrow	*Amphispiza belli*
black-throated sparrow	*Amphispiza bilineata*
lark sparrow	*Chondestes grammacus*
rufous-crowned sparrow	*Aimophila ruficeps*
golden-crowned sparrow	*Zonotrichia atricapilla*
white-crowned sparrow	*Zonotrichia leucophrys*
white-throated sparrow	*Zonotrichia albicollis*
fox sparrow	*Passerella iliaca*
chipping sparrow	*Spizella passerina*
dark-eyed junco	*Junco hyemalis*
hooded oriole	*Icterus cucullatus*
western meadowlark	*Sturnella neglecta*
red-winged blackbird	*Agelaius phoeniceus*
tricolored blackbird	*Agelaius tricolor*
yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Brewer's blackbird	*Euphagus cyanocephalus*
brown-headed cowbird	*Molothrus ater*
Family Fringillidae	
rosy finch	*Leucosticte arctoa*
purple finch	*Carpodacus purpureus*
house finch	*Carpodacus mexicanus*
lesser goldfinch	*Carduelis psaltria*
American goldfinch	*Carduelis tristis*

Lawrence's goldfinch	*Carduelis lawrencei*	
pine siskin	*Carduelis pinus*	
Family Passeridae		
house sparrow	*Passer domesticus*	I

APPENDIX C

Occurrence, Fire Effects, and Other Management Considerations for Selected Plant and Animal Species Found At Caswell Memorial State Park Listed Alphabetically by Common Name

PLANTS

Blue Elderberry (*Sambucus mexicana*)

Occurrence at Caswell: Elderberry is a very common shrub throughout the Park.

Management considerations: The valley elderberry longhorn beetle (VELB), *Desmocerus californicus dimorphus,* inhabits elderberry bushes of various sizes, ages, and growth forms, and uses an assortment of branch sizes for larval development. VELB populations inhabiting elderberries that are isolated or widely scattered are especially vulnerable to being extirpated in some parts of the range. Host plants are frequently injured through cutting and burning, and sometimes herbicides (Barr 1991). Native Americans managed the elderberry by cutting or trimming branches to encourage straight shoots. This may have encouraged new growth (B. Stevenot pers. comm.).

Buttonbush (*Cephalanthus occidentalis*)

Occurrence at Caswell: Buttonbush is occasional along the riverbanks, and is very common around the margins of the Hidden Lake where it is a dominant shrub (Quinn and Hrusa 1993).

Management considerations: Buttonbush is important to wood ducks for brood rearing and hiding. Many species of waterfowl and shorebirds eat the seeds. Bees use the buttonbush to produce honey. Buttonbush resprouts following fire. Buttonbush can become the dominant shrub in grassy, wetland areas excluded from fire. When these areas are burned, buttonbush has been observed sprouting within a few months following fire (FEIS 1998). Buttonbush is moderately susceptible to herbicides. If the shrubs become too thick, they can be reduced by cutting in the fall.

California Wild Blackberry (*Rubus ursinus*)

Occurrence at Caswell: Very common throughout the understory of the riparian and oak woodland (Quinn and Hrusa 1993). Blackberry vines provide both food and cover for riparian brush rabbits, and are a prominent component of the vegetation at occupied sites (Williams and Basey 1986).

Management considerations: Populations of California blackberries are capable of dramatic and rapid expansion on disturbed sites; they often thrive after fire. Blackberries are

common invaders of recently burned sites in the Pacific northwest. Below ground regenerative structures (nonrhizomatous basal sprouts or root "suckers") are generally well protected from effects of heat and permit rapid vegetative regeneration. Seeds commonly germinate in abundance after fire, although the plant may be top killed. High severity fires have potential to harm underground structures (FEIS 1998). Most all of the berry bushes burned fiercely during a fire on the Bobelaine Sanctuary in 1992, and carried the fire into the tree canopy (B. Clark pers. comm.).

Valley Oak (*Quercus lobata*)

Occurrence at Caswell: Very common in all areas of the Park, and is the dominant tree in the woodland immediately west of the interpretive display. These oaks are the largest trees in the Park (Quinn and Hrusa 1993).

Management considerations: Mature trees are fire resistant, while top-killed seedlings and saplings sprout from the root crown. The symbiotic relationship between this species and animals which store acorns underground favor postfire species regeneration, as the buried acorns usually survive fire. Historically, valley oak woodland burned on approximately a yearly basis, when lightening would strike the taller, older oaks (FEIS 1998). No reports of fire research on this species have been conducted within the valley oak riparian community. At Bobelaine Sanctuary very few mature oaks were lost during the severe fire which occurred in 1992. Most of the damage was done to the smaller 2- to 6-inch (5-16 cm) diameter trees (B. Clark pers. comm.).

Moderately hot fires top-kill seedlings and saplings. Trees suffering basal burning are most likely to be killed. Prescribed burning is not recommended in drought years as some authorities fear that postfire recovery may be impaired (FEIS 1998).

Sedge Family (Cyperaceae)

Species Occurrence at Caswell: Nine species of sedges have been recorded from Caswell MSP (Elems and Mederios 1977, Quinn and Hrusa 1993). Distribution, habitat requirements, and species abundance vary, as follows.

Valley sedge (*Carex barbarae),* is the dominant herbaceous species within the forest understory. These sedges are strongly rhizomatous, moderately shade-tolerant, and may benefit from occasional flooding or other actions that remove competing shrubbery (Quinn and Hrusa 1993).

Green-sheathed sedge (*Carex feta)* is found in wet areas. It is very rare in the Park, and only known from the wet banks about the Oxbow Lake, where it is uncommon.

Clustered field sedge *(Carex praegracillis)* is found in dry areas. This species is found in similar habitats to *C. barbarae,* but it is surprisingly uncommon within Caswell. *C. prae-*

gracillis and *C. barbarae* are among the most characteristic and common sedges of riparian areas. At Caswell, *C. praegracilis* is only occasional about the oak woodland. It is possible that this relatively small sedge cannot compete in a dense forest without occasional clearing of the understory, which would explain its scarcity in the Park (Quinn and Hrusa 1993).

Short-pointed cyperus *(Cyperus acuminatus)*, is occasional along riverbanks throughout the Park.

Awned cyperus *(Cyperus squarrosus),* is occasional along open, sometimes shady riverbanks throughout the Park. This plant is diminutive and easily overlooked.

Round-headed cyperus *(Cyperus difformis)* is common on open riverbanks. This species is variable in size; in shaded fertile sites it may be 2 feet (0.61 m) tall, in sunny infertile sites less than 5 inches (12.7 cm). It is abundant at the west end of the Oxbow Lake.

Perennial field-sedge *(Cyperus eragrostis)* is relatively uncommon. A few colonies are known along the riverbanks, and a single colony was found to the west of the oak woodland among valley sedge in a relatively dry site.

Red-rooted cyperus *(Cyperus erythrorhizos)* is common along the riverbanks, especially at the Oxbow Lake.

Straw-colored cyperus *(Cyperus strigosus)* is uncommon along moist riverbanks. It is known in the Park only by a single collection from the Oxbow Lake. This species resembles *C. erythrorhizos,* and without examination of the stem bases may easily be mistaken for it. Increased sampling may reveal it to be more common than indicated.

Management considerations: Sedges are an important seasonal food for riparian brush rabbits (Williams 1988) as well as a vital ingredient in the construction of traditional Native American baskets. Caswell MSP is one location where gathering of sedge roots takes place. Willard et al. (1993), documented sedge meadow regrowth after the Red Bench Fire of 1988 in Glacier National Park. The fire occurred late in the fire season under drought conditions, with high winds and low fuel moistures. By the end of the second summer postfire *Carex* spp. had regrown from buried rhizomes.

California Wild Grape (*Vitus californica*)

Occurrence at Caswell: California wild grape is a common vine throughout the Park. Notably large individuals of this species are present in the Park (Quinn and Hrusa 1993).

Management considerations: California wild grape vines growing over downed limbs and logs provide essential cover from weather and predators for both brush rabbits and woodrats. Their vines extend into trees, covering as much as 70-80% or more of some trees with

their leaves during summer. Thus, it contributes significantly to crown-fire potential as a ladder fuel. California wild grape is probably top-killed by fire, but it sprouts from the root crown after fire. It probably colonizes from animal-dispersed seeds (FEIS 1998).

Fremont Cottonwood (*Populus fremontii*)

Occurrence at Caswell: A few large trees occur along the riverbanks and slough channels. Very few or no young trees are located within the interior of the Park, suggesting the dynamics of plant succession have been disrupted by upstream water impoundments. Seedlings germinate primarily in disturbed sites along the river's edge (Quinn and Hrusa 1993).

Management considerations: Cottonwoods are an important tree for the yellow-billed cuckoo, being favored for feeding and nesting. Fremont cottonwoods are often killed by hot fires. In southern California, trees top-killed by fire sprouted vigorously from the base. Most cottonwoods readily coppice sprout following harvesting or fire. Fremont Cottonwood sprouts primarily from the stump. Sprouting depends upon season of the burn and fire severity, and declines with age (FEIS 1998).

Willows (*Salix* sp.)

Occurrence at Caswell: Gooding's Black Willows (*Salix gooddingii)* are scattered sparsely throughout the Park, being absent only from the driest areas and the oak woodland. This species most often forms a distinct tree, but is occasionally shrubby when it has recently colonized a disturbed area.

Sandbar willows (*Salix exigua)* are mostly confined to sandy, open, often recently disturbed areas. In the Park, they are found on open riverbanks, of which there are few. The largest colonies are along the upper margins of the campground beaches and on the main channel side of Oxbow Lake.

Yellow tree willows (*Salix lucida*), are occasional on the upper banks along the river. They are not as common as the other willow species in the Park, but generally form the largest trees.

Arroyo willows *(Salix lasiolepis)* are found scattered in the Park, being absent only from the driest areas. They are the most common willows in the Park, and often dominate the river banks (Quinn and Hrusa 1993).

Management considerations: Thickets of willows are a favorite habitat of both brush rabbits and woodrats. Unfortunately, most parts of the Park have only a few, scattered, mature or decadent willows, and thickets of young willows are found only in highly flood prone areas, indicating changes in plant succession and community composition since upstream dams were built (Williams and Basey 1986, Williams 1993). Most species of *Salix* sprout

vigorously after fire (FEIS 1998). Most willows survived a severe fire at the Bobelaine Sanctuary, with the exception of Gooding's willow (B. Clark pers. Comm.).

ANIMALS

Effects of wildfire on animals may be both direct and indirect. Price (1995) described these effects as occurring on a scale of minutes to days after a fire. Direct effects are usually negative: individuals are killed outright, or their food supplies or nest sites are destroyed, or they are quickly killed by predators because of lack of cover. Indirect effects are long-term, occurring on a scale of months to years, and come through changes in community characteristics, such as primary productivity, plant species composition, and structure of the plant community. Obviously, such changes can be beneficial or detrimental to resident species, depending upon the type of fire and individual habitat needs. If multispecies conservation is a primary goal, prescribed fires applied in a mosaic to enhance habitat will help prevent a catastrophic, large-scale fire that would convert the Park to a single habitat type (Price 1995).

Soil Fauna

Following fire, food supplies on the soil surface diminish to some degree. Moisture decreases, and the temperature and pH increase. These changes have been found to cause a 3 to 10-fold drop in numbers of most soil organisms and it requires 3 to 5 years for the soil fauna to reach new population equilibria (Wright 1982).

Small Mammals

Survival of small mammals within a burn depends upon the uniformity, intensity, size, and duration of the burn, as well as the mobility and position of the animal relative to the soil surface at the time of a passing fire. Relatively slow moving mammals that happen to be above the ground, such as woodrats (*Neotoma* sp.), may die directly. Mice can tolerate temperatures up to 145ºF (63ºC) for short periods of time, if the relative humidity is below 22%. Survival is greatest where the burn is incomplete in fuels of low density and high moisture content (Wright 1982). Food use patterns of small mammals indicate that after fires they use their preferred food types in relation to their abundance and availability (FEIS 1998).

Voles, mice, moles, and shrews: The broad-handed moles in Caswell MSP are the largest and only one of a few populations known from the San Joaquin Valley floor (D.F. Williams unpubl. observations). Changes in habitat by burning result in loss of shelter, food, exposure of runways and burrow openings, increased predation, and decrease in the numbers and diversity of small mammal populations for 1 to 3 years or longer after a major fire

(Wright 1982). Deer mice *(Peromyscus maniculatus),* are very adaptable to fire, and are one of the first species to recolonize burned areas in California. Fire is not destructive to small mammals that are capable of retreat to underground burrows (FEIS 1998).

Squirrels: Holocaust fires are detrimental to tree squirrels, but ground fires probably have little influence on tree squirrels. The western gray squirrel population in Caswell MSP in the only known population on the San Joaquin Valley floor (D.F. Williams unpubl. observations).

Cottontails and hares: *Sylvilagus* spp. generally exist in high density in areas that contain large amounts of dense shrubby and herbaceous undergrowth. They eat a great variety of vegetation that is enhanced by fire, but their refugia could be destroyed by severe fires. Moderate burns, which leave portions of the area unburned, may not be harmful to populations of *Sylvilagus* spp. (Wright 1982).

Woodrats: Wirtz (1995) examined responses of rodent populations to prescribed fire in Southern California chaparral and and found no survival of dusky-footed woodrats (*Neotoma fuscipes)*. Dusky-footed woodrats are most severely impacted by fire, and require the longest time to recover to prefire densities. Sauvajot (1995) found that dusky-footed woodrats, which inhabit thick brushy vegetation, become disoriented during fires, haphazardly retreating to woody nests to escape oncoming flames. Fires not only kill most or all individuals, but also destroy their stick houses (which represent a huge amount of work to build and a scarce resource for woodrats), and detrimentally alters the structure and composition of their habitat.

Birds

The immediate effect of fire on bird populations depends upon the season and intensity of a burn. A relatively cool fire during the dormant season could greatly increase food sources and leave adequate nest sites for ground and brush-foraging birds (Lowe 1978). An intermediate fire might have a similar effect for ground and brush-foraging birds and raptors. The absence of fire or other destructive forces in forest communities will be accompanied by a decrease in bird niche diversity and carrying capacity (Marshall 1963). The most important concern in fire management is to have a wide variety of relatively small, different-aged burns interspersed with some areas that have not burned for several hundred years (Wright 1982).